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THE AMERICAN GEOPHYSICAL UNION

By Dr. J. A. FLEMING

THE American Geophysical Union has to do with those theoretical or applied sciences relating to the earth, its configuration, its structure and the natural forces in operation upon or within it. Since inception in 1919, the Union has gradually developed so that now, with 1,900 members, it is perhaps the principal organization in the United States of America, acting as a clearing house for new thoughts and ideas relating to geophysics.

Sponsored by the National Academy of Sciences through the National Research Council, the executive committee of the union is the committee on geophysics of the council and is the American committee of the International Union of Geodesy and Geophysics. The functions of the union are "to promote the study of problems concerned with the figure and physics of the earth, to initiate and coordinate researches which depend upon international and national cooperation, and to provide for their scientific discussion and publication."

The wide-spread special interests of the eight sections of the union are expressed in the papers presented at the annual meetings, in the regional meetings (often held in cooperation with other scientific organizations) and in the annual "Transactions." Symposia on timely subjects are annual features of the general assemblies.

The fields of the sections of the union are briefly as follows:

(a) *Geodesy:* This section is devoted to large-scale surveying on the earth's surface, dealing particularly with triangulation, leveling and gravimetric surveys. Its objectives are principally determining the shape and size of the earth and adequate mapping of the earth's surface. Borderline subjects are earth-tides and variations of latitude.

(b) *Seismology:* This section is concerned with the solution of problems related to earthquakes and the transmission of vibratory waves through the earth. It deals with the internal constitution and surface structure of the earth which, in turn, find practical use by the geophysical prospector, the foundation engineer, the structural engineer, the geologist, the astronomer and the insurance executive.

(c) *Meteorology:* Meteorology is the scientific study of the physical processes which occur in the atmosphere and of the connected processes of the lithosphere and hydrosphere. It seeks to provide an understanding of the causes of weather and climatic conditions and their changes. These exert a profound influence on the entire course of existence of everything living or inanimate on the earth's surface and in its gaseous envelope. Meteorology is therefore of universal interest, including, as it does, all branches of pure and applied science, technology, agriculture, business, communications and transport, and military and naval strategy and tactics.

(d) *Terrestrial Magnetism and Electricity:* The field of this section is the study of the magnetic and electric phenomena of the earth's interior and atmosphere. Recent developments embrace the vital role of the magnetic and electric properties of the outer atmosphere of cosmic radiation, and of the intimate connection between the electrical and magnetic conditions of the earth and various solar phenomena. The practical utilizations in this field include isomagnetic and isoelectric charts and applications to navigation, wired and wireless communication, determination of subsurface geology and ore-deposits.

(e) *Oceanography:* Covering the greater part of the earth, the sea has a profound effect on man and the world in which he lives. In their interaction with the atmosphere, the oceans exercise a marked influence over climate and vegetation. The configuration of the ocean bottom and the action of tides and currents have an important bearing on maritime activities. Oceanic movements together with the physical and chemical properties of sea water affect marine life and thereby influence fisheries. The sea thus presents a field of research not only for the oceanographer but also for workers in bordering branches of science and in the needs of the world's commerce.

(f) *Volcanology:* The section of volcanology encourages research and the presentation of papers not only in "pure" volcanology but also in many fields such as the study of volcanic and intrusive rocks, relation of ore-deposits to igneous activity and laboratory experiments on processes of volcanism and the formation of igneous rocks and ore-deposits.

(g) *Hydrology:* The section of hydrology deals with the distribution and disposal of precipitation on the land areas of the earth, and as such is a borderline science of interest to agronomists, engineers, foresters, meteorologists, soils technicians, geologists and others, and thus forms a meeting ground for all those who are concerned with any phase of hydrology. Its membership has contributed much in the last decade to theories of precipitation, runoff, infiltration and percolation, movement of flood-waves, soil erosion and the transportation and deposition of sediment, density-currents, the behavior of ground-water, evapo-transpiration, glaciers, the physics of soil moisture and the development of useful techniques for dealing with hydrologic problems.

(h) *Tectonophysics:* The section of tectonophysics coordinates the application of physical methods and geologic and geophysical data to the solution of problems of earth structure, through laboratory experiments, geologic observations and theoretical analyses.

At the twenty-fourth annual meeting in the Hall of Government of George Washington University in Washington, on April 23 and 24, there were 475 registered members and guests. One hundred and four scientific papers and progress-reports were presented.

Nine resolutions were adopted. These relate to (1) precise surveys and maps; (2) essential geophysical observations for duration of the war; (3) implementation of meteorology for war purposes; (4) establishment of more stations in oceanic areas and Antarctica in interest of daily and long-range forecasting; (5) naval time-signal services; (6) adequate post-war program of seismological investigations; (7) practical post-war program in all branches of geophysics; (8) ways and means of providing employment for geophysicists released from war effort during the period of transition from war to peace; and (9) thanks to George Washington University for facilities extended for meeting.

Oscar Edward Meinzer—foremost authority of the United States, and perhaps of the world, on ground-water—was awarded the fifth annual William Bowie Medal for distinguished and outstanding contribution to the advancement of cooperative research in fundamental geophysics. His eminent career is singularly established in these high ideals.

J. A. Fleming was reelected general secretary of the union for 1943–1946; J. A. Duerksen was elected secretary of the section of geodesy for 1943–1946; Ernst Cloos, L. L. Nettleton and M. K. Hubbert were elected president, vice-president and secretary, respectively, of the section of tectonophysics for 1943–1946. No other elections were necessary as the terms of all other officers of the union and its sections do not expire until 1944 or later.

During the years 1919 through 1931 funds required for functioning and publications of the union were provided by the National Research Council. During these years the annual grants of the council for the

maintenance expenses varied from $200 to $1,000 and the total additional amount provided by the council in publishing some 1,250 pages of seven volumes of "Transactions" and one special report entitled "Survey of Research Problems in Geophysics" was about $7,600. With the rapid growth and influence of the union it was arranged that annual dues be contributed by each member from 1932 ($2.00 from 1932 and $3.00 since 1937) and the annual total grant from the council was reduced to an average of $400. From 1932 to date the total of annual dues was $30,337, sales of publications yielded $24,802, contributions for special purposes amounted to $7,597, and grants from the National Research Council aggregated $5,692—a grand total of $69,941. During the same interval the publication of some 26 volumes in 12 years of "Transactions" (7,967 pages in a format equivalent to 12,000 pages of the conventional printer's format), of 5 volumes (400 pages) of "Bibliography of Hydrology, United States of America," and of reprints cost $34,787, the cost of maintenance including a paid clerk from 1937 was $22,210, and the total costs of necessary equipment and special-purpose expenditures was $4,628—a grand total of $61,625. Thus on April 24, 1943, there was a reserve of about $8,316 against future maintenance and publication of the "Transactions" of 1943.

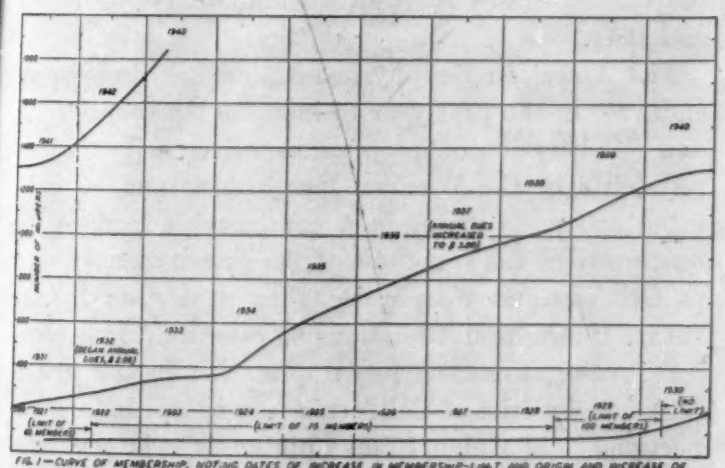

FIG. 1—CURVE OF MEMBERSHIP, NOTING DATES OF INCREASE IN MEMBERSHIP-LIMIT AND ORIGIN AND INCREASE OF ANNUAL DUES, AMERICAN GEOPHYSICAL UNION, 1921-43

This satisfactory performance is the result primarily of the economical methods of offset publication which, with the study of methods of preparing master-copy for direct reproduction, have reduced the total average cost per page for editions of 2,000 to less than one half that of the conventional form of publication in editions of 1,000 only; indeed on a strictly comparable basis of actual content of the page of our "Transactions" and editions of equal number the total cost per page is only one quarter as much. Furthermore, our "Transactions" go free of charge to each member, to a large number of libraries for public reference purposes and to between 300 and 400 of our colleagues in other countries throughout the world.

This brings us to consideration of the union's function in the international aspects of geophysics. We have found means to be represented by delegates at each of the seven triennial assemblies of that body all of which, except the seventh in 1939, were held in European cities. The seventh assembly was held in Washington through the efforts of the American Geophysical Union in cooperation with the Department of State and was judged by our foreign colleagues as one of the most successful of the seven from both points of view of attendance and of scientific discussion. To complete this undertaking the American Geophysical Union found in addition to its own funds some $18,327 to cover expenses of $17,127—over one third was provided by members of the American Geophysical Union and the remainder by generous special grants from the United States Government, the National Research Council, the Geological Society of America and the Carnegie Corporation in almost equal shares of $2,700, after refunds of $300 to each of the three last-named.

It was fortunate indeed that the last assembly, coming as it did almost simultaneously with the outbreak of hostilities, was concluded in the United States. Thus despite the interference since then because of the war with the complete functioning of the International Union of Geodesy and Geophysics, it has been possible, with our colleagues in the United Nations, to preserve a considerable part of the functioning of the international body and thus insure its continuance and its certainty of taking up its important work promptly upon the termination of the war. This has been made possible through the efforts of the officers of the International Union in Great Britain and those in the United States. Of the 33 adhering nations 17 are now Allied or neutral countries and 16 are Axis or Axis-occupied countries. Among American officers are the presidents of the Associations of Seismology and of Terrestrial Magnetism and Electricity, N. H. Heck and J. A. Fleming, and W. D. Lambert is a member of the executive committee of the Association of Geodesy. R. M. Field is chairman of the International Commission on Continental and Oceanic Structure, and J. E. Church is president of the International Commission of Snow. These men have found it possible to carry on and keep alive many of the normal operations concerned. The conditions have not been so favorable in the Associations of Scientific Hydrology and Volcanology since the officers of these associations are in occupied countries; an American, O. E. Meinzer, is chairman of the Commission of Subterranean Waters of the former, and another, T. A. Jaggar, is a vice-president of the latter association. For the Association of Meteorology, the United States is fortunate in having its secretary, Professor J. Bjerknes, in this country so that the interests in meteorology are being followed. For the Association of Oceanography, Dr. J. Proudman, of Liverpool, is secretary so that con-

tinuity of the association's activities is assured. Professor E. Rothé, secretary of the Association of Seismology, died in 1942. President D. la Cour, of the International Union, died on May 19, 1942; under the circumstances, it has not been possible to arrange for the election of a successor, but the general functioning of the union has been maintained through its general secretary, H. St. J. L. Winterbotham.

The general session of the twenty-fourth annual meeting of the American Geophysical Union on the afternoon of April 24 was devoted to a conference on the projected program of the International Commission on Continental and Oceanic Structure. This commission was formed at Edinburgh in 1936 with the instruction to devise, stimulate and sponsor geophysical-geological studies of crustal structure on a world scale, in extension and in support of the similar but less extensive studies made by some of the national organizations adhering to the International Union of Geodesy and Geophysics. Briefly, these may be summarized as follows: (1) Nature and causes of regional magnetic patterns and anomalies; (2) nature, distribution and dynamic causes of regional and gravitational anomalies; (3) nature and causes of regional and temporary variations in radio transmission and reception; (4) nature and dynamic causes of crustal deformation-patterns such as may control regional occurrence or non-occurrence of valuable mineral resources; (5) relation between possible cosmic cycles or rhythms and possible prediction of long-period rhythms as affecting climate and weather; (6) relations of relative climate, hydrology and soils. New authority has been given by General Secretary Winterbotham of the International Union for expenses of the International Commission in the furtherance of its objectives by providing $1,000 proportioned according to the contributions of the several adhering nations. The members of this commission are R. M. Field (*Chairman*); J. A. Fleming (*Secretary*); A. Angenheister, B. Helland-Hansen, O. T. Jones, Harold Jeffreys and F. A. Vening Meinesz. It has been suggested that there be added to the commission Messrs. H. U. Sverdrup, B. Gutenberg and H. H. Hess.

The American Geophysical Union has made free distribution of some 300 to 400 copies of its "Transactions" each year to members abroad of the International Union of Geodesy and Geophysics. Because of restrictions caused by the war, this distribution has been considerably curtailed since 1939, but the union is holding about 200 to 300 copies of each volume for subsequent distribution when opportunity permits.

In the field of snow the avalanche film, which was received from Switzerland through the Swiss Legation last year by President Church, of the International Commission of Snow, has been most valuable, especially in connection with war studies and training concerned with transportation and snow and avalanche conditions.

J. A. Fleming, as a vice-president of the International Union of Geodesy and Geophysics, has continued as the representative of the International Union charged with the deposits of funds of that union in this country. The only expenditures during the year on account of this fund have been $198.70 to the American Geophysical Union to cover the share of the Association of Scientific Hydrology in the expense of the publication of the "Bibliography of Hydrology of the United States of America" for 1940 and $100 to Chairman Field for preliminary expenses of the International Commission on Continental and Oceanic Structure. The payment of the dues of the United States for adherence to the union was authorized for the last year in the amount of $3,920.40 but, because of a blunder, the check for this amount was sent to London and arrangements are now under way for the return of these dues through the American Embassy in London so that the amount may be deposited with other funds of the union with the Riggs National Bank of Washington. The balance on April 24, 1943, in the account at the Riggs National Bank is $6,432.52. With the receipt from England of the last year's dues above referred to, the balance available will be about $10,350—the balance of contribution for adherence of the United States for the calendar years 1939, 1940 and 1941.

The American Geophysical Union has made every endeavor in the past year to increase the coordination and collaboration of interests, especially with the geophysicists of the Western Hemisphere and, as indicated above, to maintain a considerable part of the continuity of the functions of the International Union of Geodesy and Geophysics, thus protecting for the future international relations so essential to geophysical investigations. A recent quotation from a prominent geophysicist of California may be apt in this connection: "The Union, in my opinion, is to be congratulated for having the vision and courage to proceed with the (24th) annual meeting. The Nation needs more, not less, scientific endeavor."

In these days of total war, as never before, responsibility for continued attainment of geophysical knowledge falls with particular directness upon Americans. Now as never before, American scientists personally benefit by affiliation with their fellow specialists and co-workers, since the individual worker is under a great hardship. Now as never before, scientists in general of the Western Hemisphere need to affiliate and play their part not only in the immediate problems of applications to war-effort—to which the geophysicist is contributing effectively—but in the rehabilitation of international relations and endeavors particularly necessary to investigation of earth physics.

ACETYLCHOLINE AND THE PHYSIOLOGY OF THE NERVOUS SYSTEM

By Dr. J. F. FULTON and Dr. D. NACHMANSOHN

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IN a text-book, "Physiology of the Nervous System,"[1] published in 1938, the opinion was expressed that evidence then available to support the theory of "chemical mediation" in the central nervous system was unsatisfactory. Since the problem appeared to be at that time (early in 1938) still open to discussion, only a few short paragraphs were devoted to it. This view was criticized by Forbes[2] and later by Sir Henry Dale[3] both in the columns of SCIENCE. Sir Henry was particularly opposed to the statement that there was "no evidence fit for critical examination that would place the liberation of acetylcholine as a *primary* event, central or peripheral."[4]

Five years have now elapsed. Recent developments have changed many aspects of the problem and its reexamination is desirable. In the text-book[1] it was emphasized that the work of Eccles and Sherrington and that of Lorente de Nó indicates that the excitable properties of the central neuron do not differ fundamentally from those of the peripheral axon, except in the degree of polarization. Hence, it appears unnecessary to assume a mechanism at synapses fundamentally different from that in the axon. At the Symposium on the Synapse in 1939, Gasser and Erlanger[5] reviewing the problem arrived at the same conclusion, *i.e.*, that conduction along fibers and across synapses differ only quantitatively.

Electrical recording instruments have a high degree of perfection. With the oscillograph changes of potential are recorded virtually without inertia. It is difficult to conceive that conclusions based on electrical signs of nerve activity can be contradicted by observations based on methods which are slow, and therefore less appropriate to follow the rapid events accompanying nerve activity. The theory of Dale and his associates that acetylcholine might be the transmitting agent of nerve impulses across synapses and neuromuscular junctions, was based essentially on the type of evidence adduced previously by Otto Loewi in studying the action of autonomic nerves on effector organs: *i.e.*, liberation of acetylcholine by stimulation of motor nerves and preganglionic fibers, establishment of the stimulating action of acetylcholine in small amounts, and the potentiation of the acetylcholine effects by previous eserinisation. Although there remained some contradictions and difficulties, well summarized by Eccles[6] in his review, these were the facts that aroused suspicion and caused criticism. In the case of autonomic nerves the evidence appeared adequate for the assumption that a liberated substance acted as the "mediator"; but transmission of nerve impulses across synapses and neuromuscular junctions are rapid events which occur within milliseconds or even within a fraction of a millisecond. Sir Henry and his associates admitted that this time factor was the chief difficulty encountered by their theory. As long as the time course of the reaction was not established evidence that the liberation of acetylcholine was the *primary* event remained unsatisfactory. The liberated acetylcholine could be a byproduct of nerve metabolism, however essential for the mechanism of nervous action, but *following* the passing of the electrical change. The attempt of MacIntosh[7] to determine the correspondence between the period of preganglionic stimulation and the period during which acetylcholine is present in the perfusate by collecting the venous effluent in 30 second-samples can not be considered as an adequate approach to this essential problem of the time-relation: for 30 seconds constitute an interval some 10,000 times longer than the period during which the impulse passes through those foci.

An entirely different approach to the problem was made by Nachmansohn and his associates. They investigated the problem whether at synapses and neuromuscular junctions the rate of acetylcholine metabolism is as high as required by the assumption that it is a transmitter of nerve impulses. For, if it is the primary event in this transmission, one must postulate that it appears and disappears at least at the same speed as the electrical changes. Little is known about the mechanism of acetylcholine appearance during stimulation; but the ester is inactivated by the specific enzyme, choline esterase, which splits it into its two components. Studies on the concentration and distribution of this enzyme have revealed that at neuromuscular junctions and ganglionic synapses, as well as at all synapses of the central nervous system choline esterase is sufficiently high in concentration to split within milliseconds amounts of acetylcholine which, if released at those foci, would be in sufficient concentra-

[1] Fulton, "Physiology of the Nervous System." Oxford University Press, 1938. Pp. xv + 675.
[2] Forbes, SCIENCE, 90: 17, 1939.
[3] Dale, SCIENCE, 90: 393, 1939.
[4] Fulton, SCIENCE, 90: 110, 1939.
[5] Symposium on the Synapse, *Jour. Neurophysiol.*, 2: 361–474, 1939.
[6] Eccles, *Physiol. Rev.*, 17: 538, 1937.
[7] MacIntosh, *Jour. Physiol.*, 94: 155, 1938.

tion for a stimulating action. And if a substance can be hydrolyzed in a cell at such a high rate it is possible, and even probable, that it can appear at a similar high rate. The work on isotopes has shown that in living cells enzymes are continuously active. A high concentration of a specific enzyme can therefore be accepted as indication of the high rate of the metabolism of its substrate. The results have recently been reviewed by Nachmansohn.[8] They make possible the assumption that acetylcholine intervention is a *primary* event essential in synaptic transmission. The physiological significance of the enzyme mechanism is, moreover, emphasized by the observation that during embryonic development the time when the high enzyme concentration appears coincides with the time when the function of those foci begins.

Further investigations on the activity of choline esterase has led, however, to a modification of the original concept. The new concept is easily compatible with the conclusions of the American and Australian electrophysiologists cited above. According to this concept[9,10] acetylcholine metabolism is intrinsically connected with the electrical changes occurring everywhere at the neuronal surface. Hence, it is only quantitatively more important at the synapse where the neuronal surface increases considerably due to the extensive end-arborisation. The new concept is based essentially on two lines of evidence.

(i) *Localization of choline esterase inside the nerve cell.* In the experiments on the rate of acetylcholine hydrolysis in nervous tissue it was early noticed that the enzyme activity is high everywhere in nervous tissue and the difference between synaptic regions and axon is only a quantitative one. This was particularly obvious in non-myelinated fibers like the sympathetic chain of mammals or the abdominal chain of lobsters.[11] Hence it was concluded that acetylcholine metabolism differs only quantitatively between axon and synapse.[12] This is in agreement with the observation of Lorente de Nó[13] that acetylcholine is liberated in preganglionic fibers as well as at synapses. This observation, contested at one time by the Hampstead school, has meanwhile been confirmed by Lissak.[14] The situation became clearer when experiments on the superior cervical ganglion of cats (after section of preganglionic fibers) indicated that the enzyme might be concentrated at or near the neuronal surface.[15] Further evidence favoring this assumption has emerged from experiments on the giant axon of squids in which it was shown that the enzyme is localized almost wholly in the sheath, the amount in the axoplasm being negligible.[16]

Bio-electrical phenomena occur at surfaces. The localization of the enzyme at the surface and the high rate of acetylcholine metabolism are particularly pertinent in view of experiments in which a close parallelism could be established between the electromotive force of the action potential and the concentration of choline esterase.

(ii) *Electromotive force and concentration of choline esterase.* This parallelism has been brought out in experiments on the electric organs. The discharge of these organs is in principle identical with the action potential of ordinary nerves. The high voltage is obtained by the fact that the electric plates are arranged in series. In the electric organ of *Electrophorus electricus* (Linnaeus), the species with the most powerful electric organ as yet known, there are several thousand electroplaxes arranged in series. The maximal discharge of some specimens rises to more than 800 volts.

High concentrations of choline esterase are found in the strong electric organs of *Electrophorus electricus* and *Torpedo*. These organs hydrolyze in 60 minutes amounts of acetylcholine equivalent to 1-3 times their own weight. Since in the larger specimens the organs have a weight of several kilograms the amount of acetylcholine which can be split in these organs may amount to many kilograms in 60 minutes, *i.e.*, several milligrams in one millisecond. This high rate of metabolism makes possible the assumption that acetylcholine is closely connected with the discharge. The high enzyme concentration is particularly significant in view of the low protein (2–3 per cent.) and high water content (92 per cent.) of these organs.

In the weak electric organ of *Ray* the enzyme concentration is relatively low. If, in the three species, electromotive force per cm and number of plates per cm are compared with the concentration of choline esterase a precise relationship becomes obvious.[17] In the electric organ of *Electrophorus electricus* volts per cm, number of plates per cm, and concentration of choline esterase decrease from the head to the caudal end of the organ in an S-shaped form.[10] If the electrical changes are recorded on the same specimen and at the same section as the chemical values a close parallelism is obtained between voltage and enzyme concentration.[18] This parallelism exists, not

[8] Nachmansohn, *Yale Jour. Biol. and Med.*, 12: 565, 1940.

[9] Nachmansohn and B. Meyerhof, *Jour. Neurophysiol.*, 4: 348, 1941.

[10] Nachmansohn, Coates and Cox, *Jour. Gen. Physiol.*, 25: 75, 1941.

[11] Nachmansohn, *Compt. Rend. Soc. Biol., Paris*, 127: 894, and 128: 516, 1938.

[12] Nachmansohn, *Bull. Soc. chim. biol.*, 21: 761, 1939.

[13] Lorente de Nó, *Am. Jour. Physiol.*, 121: 331, 1938.

[14] Lissak, *Am. Jour. Physiol.*, 127: 263, 1939.

[15] Couteaux and Nachmansohn, *Proc. Soc. Exp. Biol. and Med.*, 43: 177, 1940.

[16] Boell and Nachmansohn, SCIENCE, 92: 513, 1940.

[17] Nachmansohn, SCIENCE, 91: 405, 1940.

[18] Nachmansohn, Cox, Coates and Machado. *Jour. Neurophysiol.*, 5: 499, 1942.

only in regard to the variations which occur in the same specimen, but even in absolute amounts for the variations between the individuals which are quite considerable.

The localization of choline esterase and its correlation with the electromotive force appeared to be specific. Other enzyme systems and substances studied so far—the investigations are still in progress—do not show a similar distribution nor a parallelism with the electromotive force.[18,19] An exception is the localization of vitamin B_1, determined as diphosphothiamin, which is considerably more concentrated in the sheath of the giant axon than in its axoplasm.[19] This again appears significant. Since the breakdown of pyruvic acid, which requires vitamin B_1, is probably important for the formation of acetylcholine, the high concentration of this coenzyme is in agreement with the assumption of a high rate of acetylcholine metabolism at or near the surface. On the other hand, since pyruvic oxidation is of general importance it could not be expected that the vitamin is concentrated at the surface as exclusively as is choline esterase.

The new concept removes the chief difficulty for conciliating the "electrical" and "chemical" theories of transmission of nerve impulses. For it was not the question whether the process is chemical or electrical, but whether there is or is not a special mechanism at the synapses different from that in the axon, which was the basis of the controversy. A satisfactory answer has now been found to this question. There are certainly other factors and reactions involved in the propagation of nerve impulses, but the new investigations indicate that acetylcholine in any case is an essential link in the generation of the electrical changes recorded during activity. Since $V = E - IR$ the ester may act on the surface by producing E.M.F. or decreasing the resistance, or by both. Resistance and electromotive force are closely related properties of the membrane. If an impulse reaches the polarized surface the resistance breaks down. The resting potential disappears or is even reversed. It can easily be envisaged that a polarizing or depolarizing substance which appears and disappears within milliseconds is responsible for these changes.

OBITUARY

MONT ROGERS REID

THE untimely death of Mont Reid on May 11, 1943, is mourned by the community in which he lived and by his many friends throughout the country. Rarely has a man so universally won the love and affection of his fellow citizens. That, during his illness, those in higher walks of life should have awaited daily reports of his progress; that telephone operators, taxicab drivers, hotel clerks and news-stand attendants should have inquired how he fared; that churches should have invoked special prayers for his recovery; that, on his death, the flag on the City Hall of Cincinnati should have been flown at half-mast for one not connected with government; that civic organizations should have attended his funeral services in a body; that the American Surgical Association, meeting at the time in Cincinnati, should have interrupted its scientific program to do him honor—these are but a few of the indications of the extraordinary hold he had established upon his fellows. He was in a true sense the beloved physician.

Mont Reid was born on a farm near the small town of Oriskany, Virginia, on April 7, 1889. His elementary education he obtained largely from his father, who acted as schoolmaster for his six sons and daughter. He attended the Daleville Normal School for two years, then entered Roanoke College, from which he graduated with an A.B. degree in 1908. He entered the Johns Hopkins Medical School in the fall of that year and on graduating in medicine in 1912 was appointed an intern in surgery by Dr. W. S. Halsted, the distinguished chief of the surgical department of the Johns Hopkins Hospital and professor of surgery in the Johns Hopkins Medical School. The following year, 1913 to 1914, he was an assistant resident in pathology, then returned to surgery and held the position of assistant resident surgeon from 1914 to 1918. In 1918 he was appointed resident surgeon of the Johns Hopkins Hospital, a post he occupied for three years. Following this period he was an associate surgeon of the hospital until his departure from Baltimore in 1922. Academically, he was successively instructor in pathology, instructor in surgery and associate in surgery in the Medical School.

In 1922 he accompanied the writer to Cincinnati as his associate in the newly organized department of surgery of the University of Cincinnati Medical College. It was a period of transition with all the difficulties inherent in such a period; and there is little doubt that his loyalty, sound judgment and winning personality contributed greatly to such success as was achieved in the development of the department. He became active and successful in practice and quickly won a host of friends. In 1925 he was appointed visiting professor of surgery to the Peking (later Peiping) Union Medical College of China and spent a

[19] Nachmansohn and Steinbach, *Jour. Neurophysiol.*, 5: 499, 1942.

year there, among his other activities being the organization of a medical unit which saw active service in war. He returned a victim of malaria which, for a time, considerably impaired his health; then assumed his usual work in the department. In 1931 he was appointed professor of surgery and head of the department of surgery in the Medical College and director of the Surgical Service of the Cincinnati General Hospital. These positions he occupied at his death.

Such, in bald outline, is a statement of his career. But it conveys little of his distinction as a surgeon, as a teacher of surgery, as a contributor to the art and science of surgery, as a citizen and as a man. For it can be said of Mont Reid that he won distinction in many fields. His long training under Halsted, whose principles and methods of surgery but few of his pupils better understood or more carefully followed, made him a careful, meticulous surgeon of unusually sound judgment. As a teacher he was not a brilliant lecturer nor an inspiring master of the clinic method of instruction. But at the bedside his kindness to patients, his attention to the salient facts of history, his careful physical examinations, his interpretation of clinical data, his technic in the operating room and his good judgment were an example to his students, both undergraduate and advanced, which stimulated them to do sound medicine. In his association with Halsted, whose assistant he was during his experimental work on vascular surgery, Mont Reid early in his career became interested in the surgery of the vascular system and some of his most important research lies in this field. He was also particularly interested in the surgery of the thyroid gland and contributed importantly to this subject. For the rest he was, like his distinguished teacher, concerned with the fundamental principles of surgery such as the healing of wounds and the control of infection. As a citizen he was not only interested in the development of the Medical College with which he was identified but in the affairs of his city generally; and to the Commercial Club of which he was a member he brought, no doubt, the same good judgment he exhibited in his chosen field. As a man he was tolerant, kindly, patient, and possessed an unusually winning personality which won him a host of friends and the esteem of those in all walks of life. He seems peculiarly to have fitted into his environment, a community of citizens who have an enduring memory for those who serve them well. By them, particularly, Mont Reid will not soon be forgotten.

GEORGE J. HEUER

RECENT DEATHS

DR. HERMON CAREY BUMPUS died on June 21 at the age of eighty-one years. Dr. Bumpus was from 1902 to 1911 director of the American Museum of Natural History in New York, and from 1914 to 1919 president of Tufts College.

DR. ARTHUR DEAN BEVAN, professor of surgery at the Medical School of the University of Chicago, died on June 10 at the age of eighty-two years.

SCIENTIFIC EVENTS

RULES FOR AFFILIATED HOSPITAL UNITS OF THE OFFICE OF CIVILIAN DEFENSE

REGULATIONS were issued on June 8 for Affiliated Hospital Units of the Office of Civilian Defense, of which Dr. George Baehr is the chief medical officer.

One hundred and ninety-one hospitals and medical schools have been invited by the Surgeon General of the U. S. Public Health Service to organize affiliated hospital units of the Emergency Medical Service of the U. S. Office of Civilian Defense. The invitation was extended to so large a number of civilian hospitals because each unit will be called upon for service only in a war emergency affecting its own region. Units will be activated only in event of a grave military disaster affecting the civilian population or military personnel in the area in which the parent hospital is located. Activation of a unit will take place only upon recommendation of the State Chief of Emergency Medical Service and the Office of Civilian Defense Regional Medical Officer, subject to certain limitations imposed by the Surgeon General and the Chief Medical Officer of the Office of Civilian Defense and by agreements with the invited hospitals.

Because these limitations may not as yet be understood by all physicians and hospitals which have been invited to participate in the Emergency Medical Service, the rules governing activation of affiliated units are set down as follows:

(1) Members of the staffs of affiliated units are commissioned in the inactive reserve of the U. S. Public Health Service, generally with the rank of Passed Assistant Surgeon, Surgeon or Senior Surgeon (equivalent, respectively, to Army ranks of Captain, Major or Lieutenant Colonel). They will remain on inactive status for the duration of the war unless urgent need for their services should arise in their region because of an air raid or other grave wartime disaster. When activated under such circumstances, these officers will receive the pay and allowances of officers of equivalent grades in the armed forces.

(2) The two specific purposes for which a unit may be activated are:

(*a*) For duty in an Emergency Base Hospital to which civilian casualties and other hospitalized patients must be transferred because a community is under enemy attack and one or more of its hospitals must be evacuated.

(*b*) For temporary duty to assist the armed forces at the time of an extraordinary military emergency which may temporarily overtax local military hospital facilities. Such temporary assistance will be provided in or near the locality in which an affiliated unit has been organized. The period of emergency assistance is expected to be of short duration and will last only until the Surgeon General of the Army can send in additional medical officers or until he can distribute the excessive load of sick and wounded to military hospitals in other parts of the country. Affiliated units are organized primarily for civilian protection and are not to be used to staff military hospitals as they expand to meet increasing medical requirements of the Army.

(3) Since affiliated units are organized by the Medical Division of the Office of Civilian Defense as part of the Emergency Medical Service of their states, they will be expected to provide aid only in their own or neighboring states. Their members will not be detached for duty in other parts of the country nor, in accordance with the terms of their recruitment, will they be activated for any other duty except those listed in paragraph 2 of this statement.

(4) A unit organized from the staff of a teaching hospital of a medical school will not be called unless the hospital itself must be evacuated or unless there is no unit from a non-teaching hospital to meet the emergency need.

(5) The period of obligation for service will cease at the termination of the present national emergency; the Surgeon General will accept resignations of members of units six months after cessation of hostilities.

(6) A commission in the inactive reserve of the U. S. Public Health Service does not prevent members of an affiliated unit from entering the armed forces; resignation will be accepted for this purpose.

(7) Members of affiliated units may wear the authorized lapel buttons which indicate that they have enlisted for emergency service. They are not to wear the uniform until called to active service and need not purchase a uniform unless the possibility of active service is imminent. Uniforms will not be required for brief periods of active service.

Because it is essential for civilian protection, the organization of affiliated units has received approval of the board of trustees of the American Medical Association. For the same reason, the Directing Board of the Procurement and Assignment Service has authorized "essential" physicians to accept positions in affiliated units.

SEARCH FOR MINERALS IN THE MICHIGAN UPPER PENINSULA

THE Michigan College of Mining and Technology, in cooperation with the Geological Survey division of the Department of Conservation at Lansing, is about to embark on an intensive program of investigation of minerals in the upper peninsula of the state.

Professor A. K. Snelgrove, head of the department of geological engineering, with his colleagues, Professors W. A. Seaman and V. L. Ayres, will prospect geologically the borders of the granite masses of Marquette and Baraga counties, including the Huron Mountain area, for ores of tungsten, molybdenum, beryllium, columbium, etc. Such minerals have already been found there. The task now will be to locate commercial concentrations.

Professor Bart Park, of the department of chemical engineering, aided by the department of mineral dressing, will do analytical work on the samples collected. Dr. R. A. Smith, state geologist, and Franklin G. Pardee, mine appraiser, will consult with the geologists in the field during the summer.

In the Iron River-Crystal Falls area, Iron County, the Federal and State Geological Surveys have already begun a long-term survey of iron resources. This work is being done by Drs. F. C. Park, Jr., and C. E. Dutton, federal geologists, with the collaboration of Mr. Pardee. Aerial photographs are being taken to provide up-to-date base maps. Chemical work on the iron formations, to detect other metals possibly associated with them and hitherto overlooked, will be undertaken.

The University of Michigan is cooperating with the State Geological Survey in exploring for oil and determining methods for more effective conservation. Professors K. K. Landes, chairman of the department of geology, and G. M. Ehlers will carry out stratigraphic and structural studies in the Mackinac Straits region, with particular reference to the correlation of formations exposed there with those containing oil and gas in the fields to the south. The department of chemical engineering will make a general study of the oil and gas fields and operations in the state, especially the Reed City and headquarters fields, to determine possible methods for more effective conservation. Wayne University, through Professor D. C. MacLachlan, will participate in the exploratory projects for oil.

In the copper country, governmental scientific agencies have for some time supplemented the investigations of the mining companies. Since 1942 Dr. J. J. Runner and A. A. Stromquist, of the U. S. Geological Survey, making their headquarters at Michigan College, have been studying the copper mines with a view to finding additional ore.

Stimulus for the field projects came from the Upper Peninsula Mineral Industries Conference which the college sponsored in November, 1942, when representatives of federal and state agencies met at Houghton to receive recommendations from mining companies and to formulate joint plans.

RARE CHEMICALS

THE following chemicals are wanted by the National Registry of Rare Chemicals, Armour Research Foundation, 33rd, Dearborn and Federal Streets, Chicago, Ill.:

1. Quinoline 2 Carboxylic Acid (Quinaldic Acid)
2. 2,4,5,7-Tetranitrol-1,8-dihydroxyanthraquinone
3. Tetraphenyl arsonium chloride
4. Salicylanilide
5. Salicylchloride
6. 5,15 dihydroxy palmitic acid
7. Tetramethylene Glycol
8. β,β-Dialkylphenylethylamine or its derivatives
9. Lead Tetra-acetate
10. 1-3 Cyclohexadiene
11. 1-4 Cyclohexadiene
12. Purpurogallin
13. β-Cyclocitral
14. Lead Catechol (1 lb.)
15. Myricin
16. o-Hydroxy Phenyl Mercuric Chloride
17. Cholestenone
18. Glyoxylic Acid

EXPEDITION EXHIBITION OF THE NEW YORK ZOOLOGICAL SOCIETY

IN the Zoological Park the New York Zoological Society has opened a two months' exhibition of the methods of initiating and carrying on a scientific expedition to the tropics. It represents the work of the Department of Tropical Research, and was prepared by the director, Dr. William Beebe, and Jocelyn Crane, research zoologist. It is concerned with the forty-third expedition of the department, which spent seven months in the field at Caripito, Venezuela.

Among the exhibits shown are lists of materials, methods of transportation and complete outfits for shooting, photographing and observing; all the steps from the capture of a *Urania* moth to its final publication as a color plate; and from the excavation of Cichlid fish from mud in the dry season to their incorporation in a technical article in *Zoologica;* the flocking of thousands of moths to the gigantic Standard Oil flares in the jungle; various uses of color and pattern in wild jungle life and an exhibit of old volumes dealing wholly or in part with wild creatures in Venezuela and Guiana, such as original Linnaeus, Sir Walter Raleigh, Ulloa, Humboldt, Merian, Stedman and Rohl.

An important section of the exhibit is a series of cases under the heading: "Are You Lost in the Jungle? Whether you are Scientist or Soldier, your Problems are the Same." Then follow three divisions: "Are You Afraid? Are You Hungry? Where is Camp?"

Here, supposing that the soldier or scientist has nothing but his bare hands, actual specimens or photographs and elaborate labels demonstrate his real and imaginary dangers, from *Anopheles,* perai fish, bushmasters and water buffalo, on the one hand, to tarantulas, false coral snakes, vampires and electric eels on the other. Also are shown deadly stagnant and clear jungle water, safe twice-boiled or chemically purified water and potable frog juice.

Under the hunger section is an exhibit of edible creatures from grubs to manatees which can be caught with the bare hands, together with possible foods, such as termites, snails, lizards and snakes, with methods of preparation for eating raw or cooking.

The more simple means for finding one's way when lost are demonstrated, such as use of the sun, Southern Cross, butterfly migration and the circling of a handkerchief on a tall sapling.

W. B.

BOTANICAL SURVEY OF THE ALCAN HIGHWAY

DR. HUGH M. RAUP, of the Arnold Arboretum of Harvard University, and party left Boston on May 30 for a summer's work in the field along the Alcan Highway. The party consists of Dr. and Mrs. Raup and their two children; Dr. Donovan S. Correll, a member of the staff of the Botanical Museum, Harvard University, assistant botanist, and Dr. Charles S. Denny, of Wesleyan University, geologist.

This is Dr. Raup's ninth expedition to northern Canada. The objective is a general botanical survey of the Alcan Highway, which has opened up vast areas that have never been explored botanically. Particular attention will be given to the description of immediately usable botanical resources in the vicinity of Army posts and in areas of potential settlement. The field work is being done with the cooperation of the National Museum of Canada, the Joint Economic Committees, Canada-United States, and the Army Authorities.

Field expenses of the party are covered by grants from the Milton Fund of Harvard University, the General Purpose Fund of the American Academy of Arts and Sciences, the Bache Fund of the National Academy of Sciences, the Penrose Fund of the Geological Society of America and from the general income of the Arnold Arboretum.

E. D. MERRILL

THE OPTICAL SOCIETY OF AMERICA

THE twenty-eighth annual meeting of the Optical Society of America, according to the preliminary announcement, will be held in Pittsburgh, Pa., on October 7, 8 and 9. The program will include symposia on spectroscopy, spectrochemical analysis and astronomy, in addition to the usual contributed papers.

A conference on spectroscopy and its applications

has customarily been held at the Massachusetts Institute of Technology during the month of July. Because of the continuous schedule under which the institution is now operating and the additional courses being offered for Army and Navy personnel, the facilities will not be available for a conference this summer. Arrangements are therefore being made for symposia and contributed papers on spectroscopy and related topics at the annual meeting of the society.

A midwest conference on spectrochemical analysis has been held for several years during the late spring. Tentative arrangements for a meeting this year at Columbus, Ohio, were made many months ago. When the plans of the Optical Society became known to the sponsors of this Columbus meeting, it was decided, in the interest of minimizing travel under war conditions, to cancel the plans for the Columbus meeting and to encourage the authors of papers to present them at the Pittsburgh meeting. The program committee has planned a symposium of papers on "Optics in the Field of Astronomy," the details of which are not yet available. As usual, opportunity will be provided on the program for the reading of contributed papers of general optical interest.

Because of wartime regulations governing the publication of abstracts containing material in the restricted, confidential or secret categories, it is necessary for abstracts to be cleared before the program can be released for publication. The secretary will undertake to obtain clearance of all abstracts received prior to September 1. On the other hand, it is desirable that authors submit abstracts as soon as possible in order that time may be provided for corrections or deletions by the authors if found necessary.

The meeting will be open to non-members as well as members of the society, and those interested are cordially invited to attend. Non-members who desire to receive the advance program or other information in regard to the meeting should address their requests to Arthur C. Hardy, Secretary, Optical Society of America, Massachusetts Institute of Technology, Cambridge 39, Mass.

SCIENTIFIC NOTES AND NEWS

BIRTHDAY honors of the King of England include Knighthood conferred on the Astronomer Royal, Dr. H. Spencer Jones, and on Dr. George Paget Thomson, professor of physics at the Imperial College of Science and Technology. Sir John Fraser, regius professor of clinical surgery at the University of Edinburgh, was made a baronet.

DR. BERNARD ALBERT HOUSSAY, professor of physiology at the University of Buenos Aires, and Dr. Victor Moritz Goldschmidt, professor of mineralogy and geology at the University of Oslo, on May 20 were elected foreign members of the Royal Society, London.

DR. ELLIOTT PROCTOR JOSLIN, professor emeritus of clinical medicine of Harvard University, has received the distinguished service medal and award of the American Medical Association.

A TESTIMONIAL dinner was accorded to Dr. Herbert M. Evans, Morris Hertzstein professor of biology and director of the Institute of Experimental Biology, on June 4, by members of the medical and other faculties of the University of California in celebration of his sixtieth birthday. The celebration was held at the Bohemian Club, San Francisco, under the chairmanship of Dr. William J. Kerr, professor of medicine. On this occasion presentation was made of an anniversary volume published by the University of California Press, "Essays in Biology," containing forty-eight scientific contributions from pupils, associates and friends representing the physiology of reproduction, endocrinology, nutrition and the history of medicine and science. The publication was planned before the present world war and the participants are leading foreign and American workers in their respective fields.

DR. HUGH S. CUMMING, surgeon general, retired, U. S. Public Health Service, is the recipient of new honors. According to the *Harvard Alumni Bulletin*, recently at the Mexican Embassy in Washington, Dr. Victor Fernandez Manero, national director of health of Mexico, conferred on him in behalf of the President of Mexico the decoration, Doctor Eduardo Liceago. At the invitation of the Government of the Dominican Republic, Dr. Cumming lately went to that country to advise the public health authorities of the Republic on matters of health and sanitation. While in Ciudad Trujillo, the President of the Republic, General Rafael Trujillo, conferred upon him the decoration, Orden del Merito, Juan Pablo Duarte. During his visit there Dr. Cumming was made an honorary professor of the University of Santo Domingo, the oldest university on the Western Continent. He was also made an honorary member of the Medical Society of the Dominican Republic.

DR. DAVID RUSSELL LYMAN, of Wallingford, Conn., was presented with the Trudeau Medal for 1943 at the St. Louis meeting on May 5 and 6 of the National Tuberculosis Association.

AT the commencement exercises of Syracuse University, the Arents Medal for distinguished achieve-

ment was awarded to Carl L. Bausch, vice-president in charge of engineering and research of the Bausch and Lomb Optical Company. Arents medals are awarded annually to alumni of Syracuse University through a fund established for this purpose by George Arents, a trustee.

THE University of Chicago on June 12 awarded citations as "distinguished alumni" to fifty-five members of the college classes prior to 1911, including *Astronomer,* Edwin P. Hubble; *Chemist,* Robert R. Williams; *Geographers,* Charles Colby and Stephen S. Visher; *Geologists,* Fred H. Kay and Arthur C. Trowbridge; *Economist,* Harold G. Moulton; *Physicist,* Harvey B. Lemon; *Physiologists,* Arno B. Luckhardt, Franklin C. McLean and Herman A. Spoehr.

DR. WORTLEY F. RUDD, dean of the school of pharmacy and professor of chemistry at the Medical College of Virginia, was honored at a dinner recently by members of the Virginia Section of the American Chemical Society for his part in organizing the section in 1913, the Virginia Academy of Science in 1921 and the Southern Association of Science and Industry in 1941.

IN recognition of his work in the synthesis and manufacture of atabrine, the degree of doctor of science of St. Lawrence University was conferred at commencement on Dr. A. E. Sherndal, plant superintendent of the Winthrop Chemical Company, who was recently elected vice-president of the company.

HARVEY MILTON MERKER, superintendent of manufacturing for Parke, Davis and Company, was awarded by Wayne University the honorary degree of doctor of science in chemistry at the annual commencement exercises on June 17.

DR. WORTH HALE, since 1918 associate professor of pharmacology and assistant dean of the faculty of medicine at Harvard University, will retire from active service on August 31.

DR. A. A. BERG, consulting surgeon at Mount Sinai and Montefiore Hospitals, has been chosen president-elect of the International College of Surgeons to take office as president in 1945.

DR. W. V. CRUESS, head of the fruit products laboratory of the University of California at Berkeley, was elected president of the Institute of Food Technologists at the annual convention of the institute, which met in St. Louis on June 2, 3 and 4.

DR. ARTHUR B. LAMB is retiring as dean of the Graduate School of Arts and Sciences of Harvard University to return to full-time work in the department of chemistry. He is succeeded as dean by Dr. Howard Mumford Jones, professor of English. Dr. Leigh Hoadley, professor of zoology and master of Leverett House, has been appointed to one of two newly established associate deanships of the school.

DR. WM. DEB. MACNIDER, Kenan research professor of pharmacology and head of the department of pharmacology of the School of Medicine of the University of North Carolina, has relinquished the headship to become effective on September 1. He will continue in the department as a research professor.

DR. SAMUEL J. KIEHL, professor of chemistry at Columbia University, will retire on June 30 after serving on the faculty for twenty-six years. He was appointed professor of chemistry in 1938.

DR. C. P. RHOADS, director of Memorial Hospital for the Treatment of Cancer and Allied Diseases, New York City, has been given leave of absence to become chief of the Medical Division of the Chemical Warfare Service of the United States Army, with the rank of colonel. Dr. F. W. Stewart, pathologist, has been appointed acting director, with Dr. Howard Taylor, Jr., as his assistant.

DR. DONALD K. TRESSLER, since 1933 head of the division of chemistry at the New York State Experiment Station, Geneva, has joined the staff of the General Electric Company. He will be concerned chiefly with research on refrigeration and the freezing preservation of foods, working at the laboratories at Bridgeport, Conn.

DR. EDWARD DAWSON DAVY, professor of pharmaceutical chemistry and dean of the School of Pharmacy of Western Reserve University, Cleveland, has been appointed director of the pharmaceutical division of the Winthrop Chemical Company. He will make his headquarters at the plant at Rensselaer, N. Y. Dr. Davy has been associated with Western Reserve University for the past twenty-one years.

DR. STEUART HENDERSON BRITT, who has been director of the Office of Psychological Personnel of the National Research Council, has been commissioned a Lieutenant D-V(S) in the United States Naval Reserve.

BERT E. GROVE, a member of the Raymond Foundation lecture staff of Field Museum of Natural History, has been called to active service with the Army. He will serve with the medical corps. His first assignment is at Camp Custer, Battle Creek, Mich.

LIEUTENANT DONALD T. RIES, formerly park naturalist at Starved Rock State Park, Illinois, and now of the Army Sanitary Corps, has been transferred from Camp Grant, Illinois, and is now at the Station Hospital, Camp Cooke, California, where he is assistant medical inspector.

DR. T. HARPER GOODSPEED, professor of botany and director of the botanical garden of the University of

California at Berkeley, has returned from an expedition to the Andes, after having spent a year and a half in South America, bringing back a collection of dried plants, photographs and picture films. He also represented the Committee on Inter-American Artistic and Intellectual Relations. In this connection he gave two hundred lectures throughout Chile, Peru, Colombia and Argentina and gave numerous showings of three moving picture films in color. At the request of the president of Chile, he selected a site and worked out plans for a national botanical garden and in Peru he reorganized the garden in Lima.

AT a meeting of the Physical Society, London, on June 4, Professor F. C. Bartlett, F.R.S., gave the Thomas Young Oration on "Some Current Problems in Visual Functions and Visual Perception."

THE Anglo-Polish Committee, London, held on May 24 a meeting of commemoration of the four hundredth anniversary of the death of Copernicus at the Royal Institution, London.

To insure a continuous supply of scientifically trained personnel for war industries, a committee of the American Institute of Chemical Engineers, of which Dean Frank C. Whitmore, of the Pennsylvania State College, is chairman, has drawn up a plan, suggesting that all able-bodied men in college, scientific and engineering fields be inducted into the armed forces when they reach the age of eighteen years, but that the thirteen weeks of basic training be omitted and instead that the men be retained in college for further technical training. It is also suggested that the armed services select not over fifty per cent. of such students for active duty, reserving the remaining fifty per cent. to complete their training and enter war industries. At the present time there is no provision for recruiting for war industry. This plan is designed to strengthen the home front as well as the battle front, and to provide the men on the battle front with adequate supplies of essential equipment.

FOR the first time in the history of the Evening Division of the New York University College of Engineering a summer program of degree courses in nearly all departments of engineering will be offered, beginning on July 7. The program was formulated as the result of a survey made in the evening division earlier this year, which indicated that there is a general desire among the students to accelerate their degree training. The majority of the students of the Evening Division are employed during the daytime, many of them with the engineering departments of vital war industries for whom the study of engineering in the evening is an actual adjunct to their positions.

THE Board of Estimate of New York City has agreed to the proposal for post-war construction at Coney Island of a large oceanarium, or aquarium, replacing the abandoned aquarium in Battery Park. Reversing its action of May 6, the board, by a vote of 10 to 5, approved a capital budget amendment providing $42,000 for preparation of plans for the project. The amendment must now be approved by the City Council, where its passage is considered certain, and then the Board of Estimate must give final authorization for the expenditure of the funds. To the $42,000 to be provided by the city, the New York Zoological Society will add $20,000, so that $62,000 will be available for planning the project, which is expected to cost $1,502,000.

DISCUSSION

THE MOBILIZATION OF SCIENCE

THE Kilgore bill (S. 702) amply illustrates the old adage that the road to hell may be paved with good intentions; for while professing beneficent aims toward scientists and technologists, it would in effect turn them over to the power of partisan politics, besides hampering or emasculating the drive of individual effort. According to Dr. Harold G. Moulton, of the Brookings Institution, the government had in its employ in 1939 more than 40,000 scientists, and in wartime a very much larger number.[1] Furthermore, there is no telling how great this number would become if we include all those to be classified as "scientists and technologists" by the false and distorted meanings proposed for these terms in the Kilgore bill, which states (Sec. 2 (b)) (italics mine):

> "Scientific and technical personnel" shall include all persons, excepting physicians and dentists, who *have completed any* course of study in *any* college or university in *any* branch of science or its practical application or who have had not less than an aggregate of six months' training or employment in *any* scientific or technical vocation.

After one semester, college freshmen would become "scientists" whether they passed or not, and any worker in a chemical factory, for example, would become a "technologist" in six months, irrespective of his competence. I must recall here a question posed by Lincoln in his debates with Douglas. Lincoln said: "If you call a dog's tail a leg, how many legs has a dog?" And when many in the audience answered "Five," Lincoln replied: "No, only four. Calling a dog's tail a leg does not make it a leg." This falsification of the meanings of the words "scientist" and

[1] SCIENCE, 96: 524, 1942.

"technologist" would not increase the number of *real* scientists and technologists, but it would classify with them enormous numbers of incompetents and great numbers of members of many labor unions, whose united votes would drown out real scientific opinion. I query if this is an object of the bill.

There seems to be considerable misunderstanding as to the extent to which scientists are "mobilized." *The New York Times* editorial which is printed in SCIENCE for May 28 states: "Despite assertions to the contrary, scientists and technologists are not fully mobilized"; and in the issue of June 4, L. C. Dunn points "to the thousands of biologists of all kinds, of geologists, mathematicians and other scientists whose work has no immediate relation to the war; and to the many laboratories which are operating as usual without reference to either the war or the government." It is true that many scientists are carrying on the control of food and water supplies and the numerous manufacturing operations by which are produced most of the necessities for the civilian population as well as for the armed forces, and also training and teaching more chemists, engineers and other scientists and technologists—but all this is *important* to the conduct of the war, even if it has no *immediate* relation.

Furthermore, the word "mobilized" is a weasel word. Competent scientists and technologists are listed in the membership lists of hundreds of scientific and technical societies and in professional directories, and have also been listed by the National Roster of Scientific and Specialized Personnel. I have yet to hear of cases where scientists have refused to answer a government call; even though many of them probably never will be called, they are all ready to serve, if and when their services are called for. Just as only a few of those "mobilized" in our armed forces are on the actual firing line at any moment, so too many scientists must abide finding their proper and wanted call to the war effort. As Milton wrote: "They also serve, who only stand and wait." And in the meanwhile, they keep the home fires burning. Any attempt to supersede the thousands of actively operating scientific and technological agencies by a dominant group of appointees would be disastrous. And of the seven "top" appointees, only two must be "scientists and technologists" in the falsified meaning of these words.

Human nature and politics being what they are, nepotism and favoritism are not impossible in appointive positions, and government "brass hats" do not always recognize real merit and advanced ideas, as General "Billy" Mitchell and General de Gaulle found out. With the intense competition existing not only in individual businesses but also between whole industries, the urge to develop and perfect new methods and materials and products has led to outstanding advances. Our government scientists do splendid work within their limitations and render great public service; but consider the great array of new products, medicines and machinery (electric iceboxes, autos, vacuum sweepers, vitamins, improved lighting and transportation, etc.) which have been brought to the public at great savings in cost by industrial laboratories. We have Nylon to replace silk and quite a number of "synthetic rubbers"; radios; substitutes for many raw materials cut off by the war; magnesium and aluminum at low cost, etc., etc. According to *Mining and Metallurgy* (April, 1943), under the best conditions only about 5 per cent. of the total development cost of most products is claimed by laboratory research and patent prosecution—the balance goes into pilot-plant research, experimental design and construction and in getting the process into commercial operation. Following Langley's unsuccessful attempt to fly his apparatus, financed by Congress, nothing was done of account until two enthusiastic bicycle mechanics, the Wright Brothers, built and flew their own machine, and established the airplane industry.

Despite the good intentions behind those who framed and support the Kilgore bill, its results will be evil. Neither science nor technology, nor scientists nor technologists will thrive under regimentation. Far from being a "Magna Charta of Science," as Thurman Arnold called it, it might well become a tangle of chains to enslave science and industry. We must guard against unwise concentration of power in the hands of appointees and sub-appointees, and its possible and even probable misuse or abuse, with results that can now be seen in Germany, Japan and Italy.

JEROME ALEXANDER

BIOLOGY AND THE KILGORE BILL

PROFESSOR L. C. DUNN in an article[1] entitled "The Opposition to the Kilgore Bill" takes Dr. Gustav Egloff severely to task for certain of his recent statements concerning the bill, one of which was that "over 95 per cent. of our scientific and technical manpower and facilities are now highly organized and coordinated to the single end of advancing the war effort." Professor Dunn asserts that this statement is certainly not true and goes on to say that "one has only to point to the thousands of biologists of all kinds, of geologists, mathematicians and other scientists whose work has no immediate relation to the war. . . ."

To support his contention, Professor Dunn quotes from an article by Professor J. S. Nicholas, "The War Problem of Manpower in Biology and Agriculture," commenting thereon as follows: [Professor

[1] SCIENCE, 97: 510–11, 1943.

Nicholas] "estimates that in the biological sciences alone exclusive of medicine, there are available about 67,000 scientists."[2]

Professor Dunn appears to have completely misread Professor Nicholas's article, the purpose of which was to show the vital relation of the work of the said estimated 67,000 biological scientists to the war effort. In fact, his whole article is a plea for the conservation of manpower in the biological sciences to prevent an imminent shortage of workers in these fields so essential to the maintenance of our war effort.

A few quotations from Professor Nicholas's article will make this abundantly clear:

> The services must be fed and clothed, and increased amounts of materials essential to these vital functions must be produced by a campaign of blood and sweat as rigorous as that involved in the mining of metals or the extraction of fuel. No other field must contribute so much to the war effort in material and in morale as do biology and agriculture; they provide the ultimate foundation for victory. . . . At no time in our history has this group been loaded with a greater responsibility. This it accepts, asking only that Selective Service carefully consider the importance of the biological group and the maintenance of its personnel; that legislative planners be brought, if possible, to think of how serious and far-reaching would be the effect of ill-considered restrictions of its efforts.

This is a far cry from Professor Dunn's assertions implying that 67,000 biological scientists are available for war work. He evidently disagrees with Napoleon that "An army travels on its stomach" and apparently would have us believe that the only people whose work relates immediately to the war are those who make bullets and those who fire them.

DONALD PRICE

NEW YORK, N. Y.

THE MOSCOW SCHOOL OF TOPOLOGY[1]

FROM a purely logical point of view, topology, the mathematical science of continuity, is one of the most fundamental branches of mathematics. According to Hermann Weyl, all mathematics grows out of algebra, which studies the realm of discrete operations with numbers and other mathematical symbols, and topology unites these symbols into continuous variations.

From a more practical point of view, topology occupies one of the key positions among the many different branches of modern mathematical science. In nearly all these branches of mathematics as well as in many fields of physics and engineering there is an increasing number of problems where the essential difficulty of solution lies in working out a subtle quantitative analysis which can be performed only by topological methods.

Little wonder, then, that topology attracts the special attention of mathematicians the world over. Henri Poincaré, the greatest mathematician of the beginning of this century, devoted his most profound research efforts to topology. In the United States of America topology and its applications occupy almost exclusively such great scientists as Birkhoff, Veblen, Alexander and Lefschetz. The energetic work and brilliant discoveries of the last three mentioned scientists have made Princeton a world center of topological thought which has given refuge to such famous European scientists as Hermann Weyl and J. V. Neumann.

A school of topologists working no less intensively was established in the U.S.S.R. by Paul Uryson, Paul Alexandrov and Leo Pontryagin. Even the initial works of Alexandrov and Uryson, which were done in 1920–1924, created large new branches of topology—the theory of dimensions of Uryson and the theory of bicompact spaces of Alexandrov. Uryson died at the age of 26 and Alexandrov devoted himself with exceptional energy to arranging and publishing Uryson's unfinished work, an activity which resulted in a number of sizable memoirs. Alexandrov at the same time introduced a new trend into topology by devoting his efforts to a synthesis of the classical combinational topology of simplest geometrical figures with general ideas of theoretical-multiple nature. The general combinational topology created by him has become one of the fundamental trends for further research by topologists and mathematicians the world over.

By the end of the twenties Alexandrov's pupil, Leo Pontryagin (now a corresponding member of the Academy of Sciences), collaborated in his teacher's research. After his initial efforts, which constituted a continuation of Alexandrov's work, Pontryagin turned his attention to the theory of continuous groups in which he achieved fundamental results, changing this branch of mathematics at its very roots. His basic accomplishments were published in a book which appeared in 1939 simultaneously in the U.S.S.R. and U.S.A.

In addition to Pontryagin, a brilliant group of pupils has gathered around Alexandrov. Among them are Andrei Tikhonov, Leo Tumarkin and Alexander Kurosh. These men have done a great deal both in topology and in its applications. For instance, Tikhonov (who is now also a corresponding member of the Academy of Sciences) applies topological methods successfully to mathematical analysis and geophysics.

The work of Soviet topologists continues with unabating intensity even in wartime. Alexandrov himself completed during 1941–1942 his fundamental research on the properties of the mutual disposition of

[2] *The Sigma Xi Quarterly*, 30: 4, 294–97, 1942.

[1] Received via radio by the American Association of Scientific Workers.

geometrical figures for which he was granted one of the Stalin first prizes for 1942. Pontryagin, Tikhonov and several other topologists are now actively working on special war problems.

A number of topologists of the younger generation are in the ranks of the Red Army. Some of them send their scientific works to the Academy of Sciences for publication in its Reports, even from the front. Graduate students Shanin and Fomin completed their topological work while in the Red Army and came from the front to take their examinations.

Soviet topologists strive even under the most trying conditions of war not to lose their place in the international cooperation of mathematics.

ANDREI KOLMOGOROV
ACADEMY OF SCIENCES OF THE U.S.S.R.

SCIENTIFIC BOOKS

METEOROLOGY AND CLIMATOLOGY

Basic Principles of Weather Forecasting. By VICTOR P. STARR. 299 pp. 125 figs. New York: Harper and Brothers. 1942.

Workbook in Meteorology. By ATHELSTAN F. SPILHAUS and JAMES E. MILLER. 163 pp. Figs. and maps in end pocket. New York: McGraw-Hill. 1942. $3.00.

Climatology, General and Regional. By THOMAS A. BLAIR. 478 pp. 101 figs. 1 fold map. New York: Prentice-Hall. 1942. $5.00.

An Introduction to the Study of Weather and Climate. By HAROLD B. WARD and WILLIAM E. POWERS. 112 pp. 24 figs. Evanston, Ill.: Privately printed. 1942.

Ways of the Weather. By W. J. HUMPHREYS. 400 pp. 75 figs. Lancaster, Pa.: The Jaques Cattell Press. 1942. $4.00.

THE publication of Espy's epoch-making "Philosophy of Storms" a century ago initiated a period of great development in meteorology in this country. Espy had recruited a corps of volunteer weather observers in the eastern part of the United States, and from the reports received from them by mail he undertook to systematize the information on size, form and rate and direction of travel of individual storms. The later development of the telegraph made it possible to get weather reports quickly and led to the conviction that the weather could be foretold. For a few years prior to the Civil War the Smithsonian Institution issued daily public weather forecasts. Official meteorological services were established in many countries during the 1870's; our own was created in the first year of that decade within the Army Signal Service. Thus meteorology in this country became an official technology and the responsibility for its welfare rested in a government agency, which presently was reorganized and became the Weather Bureau. The chief preoccupation of the bureau was with weather forecasting.

There were no trained meteorologists and unfortunately little encouragement was given to the development of adequate training facilities in the universities. New employees in the Weather Bureau were recruited at the sub-professional level and were trained through a system of apprenticeship to fill professional positions. University administrators were not willing to establish facilities for training and for research in meteorology so long as there were no professional opportunities for graduates.

With the rapid development of commercial and military aviation during the last 20 years there arose a need for weather forecasts more detailed and specialized than the Weather Bureau could provide. In 1927, with the support of the Guggenheim Fund for the Promotion of Aeronautics, an experimental airways weather service was established for the air route between Los Angeles and San Francisco. Carl-Gustaf Rossby was selected to conduct the trial. This airways weather service quickly proved that meteorology could be of inestimable service to aviation and a need for trained meteorologists soon became evident. With the support of the Guggenheim Fund, a meteorology course was instituted at the Massachusetts Institute of Technology in 1928, with Rossby in charge. Gradually, young men who had taken this course began to make themselves felt in the Army and the Navy and in civil aviation. At the same time fundamental research in meteorology was greatly stimulated and graduate work in the subject led to the conferring of the first Sc.D. degree in meteorology in this country about eight years ago. During the last five years Rossby and his students have been responsible for the establishment of departments of meteorology in three other first-rate institutions: New York University (1938), the University of Chicago (1940) and the University of California at Los Angeles (1940).

A logical by-product of the phenomenal growth of aeronautical meteorology in the last decade has been the publication of text-books. Already they occupy a five-foot shelf and they are mostly of very high quality. In the main, however, they are strongly biased by the special needs of aviation and do not even claim to treat of the whole of meteorology. For this state of affairs Rossby and his associates can not be blamed. They realize that there can be no important advance in the art of weather forecasting without

much fundamental work in the science of meteorology. They realize further that there can be no full and sound development of the science so long as any part of it remains neglected.

Nevertheless, there is no opportunity at present for them to do much to round out the development of the science. The present wartime emphasis on military aviation has brought literally thousands of Army and Navy cadets to the existing meteorology departments for training as weather forecasters. The facilities of these schools were so severely overtaxed that both the Army and Navy have found it necessary to establish new schools for training in weather forecasting.

The need for speed in training of weather forecasters for the military services has created many extremely difficult pedagogical problems. The students are not allowed time to acquire an adequate knowledge of the physics of the atmosphere; instead their training in forecasting is reduced, in so far as possible, to a series of empirical rules, and entails as much practice in the laboratory as time will permit.

"Basic Principles of Weather Forecasting" was written for use in the present accelerated training program. Mr. Starr directs the work in experimental weather forecasting in the Institute of Meteorology at the University of Chicago. He has developed special competence in making forecasts from the observations that can be obtained at a single station. Such forecasts are, of course, extremely valuable in many fields of military operation, since there are times when synoptic observations from other stations are unobtainable. The book is almost completely non-mathematical: there are scarcely a dozen equations in it and these are far from formidable. The basic principles are brought together in the first two chapters, the first of which deals with forecasting the field of motion in the atmosphere and the second with forecasting of the actual weather from the field of motion. There are only a few pages on the general atmospheric circulation. Most of the remainder of the book discusses a series of examples of weather forecasts for each of the four seasons. The author makes skilful use of carefully selected synoptic charts and charts of upper-air soundings. The book ends with a brief description of current work on extended-period forecasting. Mr. Starr is a good teacher as well as a skilful forecaster and his book profits from both of these qualities. It should be especially useful in the present emergency.

"Workbook in Meteorology" was also prepared to assist in the rapid training of students in the art of weather forecasting. Its four parts deal successively with climate (mean condition of the atmosphere), instruments and methods of observation, the elements of dynamic meteorology and the weather map. Most of the exercises are carefully prepared and are purposeful; the text is thoughtfully written and the instructions are clear and concise. Unfortunately, there are a few exercises that will be recognized even by the student as busy work. The questions that follow some of the exercises could have been much better. They are mostly of the simple true-false type (the mean position of the heat equator is [north, south] of the geographic equator) and add little to the student's understanding of the work he has been doing. Nor do they help the instructor to estimate the progress of the student. Nevertheless, this workbook should be a most useful laboratory teaching aid and there is little doubt that it will be widely adopted. "Workbook in Weather Forecasting" would be a better title.

There is one part of meteorology that has been neglected more than any other. This part is climatology. A century ago meteorology was mainly climatology, but after the possibilities of weather forecasting came to be realized, the content of meteorology became more and more restricted until to-day it consists almost entirely of "weatherology." In fact, it is no longer realized that climatology is an integral part of meteorology, coordinate with "weatherology" and of equal importance to it. Both subdivisions of meteorology use the same instruments and the same observational data. One is concerned with irregular short-time fluctuations in the state of the atmosphere, whereas the other has to do with the regularly recurrent or periodic changes in the state of the atmosphere from day to night and from winter to summer. The conditions of the atmosphere to be expected at any place over a period of time constitute its climate.

Just as meteorology ("weatherology") is given practical expression in weather forecasting, so climatology finds practical application conspicuously in the fields of agriculture, biology and geography. But climatology has not reached the stage of practical application nearly to the extent that "weatherology" has. Climatology remains largely descriptive; physical climatology is virtually unexplored in this country. Perhaps it will require pressure from the agricultural interests, like that exerted by the aviation interests to secure improved forecasts, before physical climatology will be developed to a point where it can serve practical ends.

Much of the current literature of climatology is written by the geographers. They have a very real interest in climatology because they regard climate as the key to the areal differentiation of the earth. The study of descriptive climatology has, thus, been diligently pursued and studies of the climate of particular places and regions are numerous.

There are a number of text-books on climatology written in the English language. They are largely descriptive and have more or less similar organization, giving information on temperature, rainfall, humidity, pressure and wind for various parts of the earth.

Blair's "Climatology" is such a book. It is no better, and perhaps no worse, than others that have appeared in the past. It will certainly do nothing to advance the science of climatology or to raise the level of teaching of the subject in the United States. The writing is dull and the illustrations are poorly selected and executed. The first quarter of the book deals with what is called general climatology and the remainder with the climates of the world. The book contains some modern material, but it is not adequately assimilated into the text. For example, appended to the discussion of the general circulation, which follows Ferrell quite literally, there is a brief paragraph on air masses. It may be presumed that Rossby's lucid discussion of the general circulation in the 1941 Yearbook of Agriculture (Climate and Man) was available to the author. At least it is listed in the bibliography. Yet there is no indication that he made any use of it.

The failure to deal satisfactorily with the various climatic controls, and particularly the general circulation, makes difficult the discussion of the climates of various regions. For example, when explaining the arid parts of North America he says, in part (page 173), "The southern portion of this dry-climate area, from southern California to Texas and southward into Mexico, is in the subtropical belt of high pressure, which is characteristically dry around the world. In winter, the winds are from north or northwest out of the Great Basin center of high pressure, and they decrease in humidity as they move southward to warmer latitudes. In summer the inflowing winds on the Pacific side pass over the abnormally cool water along the California and Lower California coasts, and hence are dry as they move inland over the very warm land surface." This explanation is repeated in the discussion of the factors influencing the climate of California (page 202).

As a matter of fact, the air that passes over southern California in summer is not dry; it contains three times as much moisture as in winter. Only in the Gulf and South Atlantic states is the summer air moister. Summer rainfall is deficient over southern California because a mechanism for precipitating the abundant atmospheric moisture is lacking. In "Characteristic Weather Phenomena of California" Byers has explained the peculiar rainfall régime of California clearly and simply. It can not be said that the explanation is too complicated for climatology students.

Blair says (page 12) that there are only three methods of transmitting heat: radiation, conduction and convection. The most important process for redistributing heat over the earth's surface, advection, is ignored. So is the most important process for the vertical transport of heat, mechanical turbulence. Convective turbulence is mentioned as the principal cause of high fogs in central California (page 203), but the process is nowhere explained.

"Weather and Climate" is a privately printed book of 112 pages that presumes to cover the whole field of meteorology. It fails completely. There are 10 chapters as follows: earth relations (6 pages), the atmosphere (10 pages), the heating and cooling of the earth (8 pages), atmospheric pressure and winds (6 pages), the moisture of the atmosphere (10 pages), the general circulation of the atmosphere (6 pages), the seasons (2 pages), aperiodic migratory cyclones and anticyclones (19 pages), the weather map and forecasting (9 pages) and climate (22 pages).

This statistical summary of the contents of the book does not tell the whole story of its inadequacy. Of the 6 pages in the chapter on earth relations 5 are irrelevant by any standard in a book on this subject. Three of the 6 pages on atmospheric pressure and winds are wasted on useless illustrations. The chapter on migratory cyclones and anticyclones contains a two-page half-tone reproduction of a daily weather map which is almost completely illegible and of which no use is made in the text. A footnote states, "The map . . . has been cut and made smaller so that some of the explanatory material is omitted." This is not of any importance because the part that remains can not be read. That a world survey of climate can hardly be achieved in a space of 18 pages is obvious. This book is about the equivalent of the corresponding part of a high-school text in general science. One wonders if it is being used in college classes.

The subtitle of "Ways of the Weather" is "A cultural survey of meteorology." It was published in the "Humanizing Science" series of the Jaques Cattell Press. Only Dr. Humphreys could have written this book. He has a rigorous scientific background and at the same time a rare ability to explain things simply and interestingly. His ready wit and his sprightly style are seen here at their best. Little is overlooked in the book; in fact the reader is given a bonus of material not ordinarily found in meteorology texts. Here the author is following the precedent established by his earlier work, "Physics of the Air," but there is an important difference. For example, what he then labeled "meteorological acoustics" he now calls "weather music." Where else can we get a scientific explanation of the murmur of the forest, the roar of the tornado, the howling of the wind, the clatter of hail, the rattle of sleet, the patter of rain, the detonation of meteorites, the swish of the Aurora and the song of the four-horse wagon, in non-scientific language?

Such abstruse subjects as "structure of the atmosphere," "distribution of temperature," "distribution of water vapor" and "distribution and changes of atmospheric pressure" do not readily lend themselves to

interesting presentation for the lay reader, but Dr. Humphreys has made them interesting. Still, "Ways of the Weather" is not for the lay reader alone; it is a book that every professional meteorologist should have, if for no other reason, because it presents the old and familiar substance of meteorology in a new and fresh garb.

C. W. THORNTHWAITE

SOCIETIES AND MEETINGS

THE ILLINOIS STATE ACADEMY OF SCIENCE

THE Illinois State Academy of Science held its thirty-sixth annual meeting on May 7 and 8, at Jacksonville, Illinois, with MacMurray College and Illinois College as hosts. Attendance, although smaller than in recent years, was larger than had been expected, with 329 persons registered.

On the morning of May 7, a general session in Jones Chapel on the Illinois College campus featured two timely addresses. The retiring academy president, F. M. Fryxell, Augustana College, spoke on "American Science in the Development of the Philippines," and Dr. Edson S. Babson, professor of geology, University of Chicago, spoke earnestly of our natural heritage, its benefits and its menace.

During the afternoon of May 7, ten sections of the academy met separately under the direction of section chairmen, in quarters provided by MacMurray College, for the reading of papers by academy members. The Agriculture Section, Dr. O. L. Whalin, University of Illinois, chairman, heard nine papers and had an attendance of nineteen persons. The Anthropology Section, Mr. Ben Nussbaum, Fairbury, chairman, heard ten papers and had an attendance of sixty-five persons. The Botany Section, Dr. K. Richard Johnson, National College of Education, chairman, heard eight papers and had an attendance of twenty-two persons. The Chemistry Section, Dr. H. W. Gould, Northern Illinois State Teachers College, chairman, heard ten papers and had an attendance of twenty. The Geography Section, Dr. L. A. Holmes, State Normal University, chairman, heard four papers by four attendants. The Geology Section, Dr. William E. Powers, Northwestern University, chairman, heard thirteen papers and had thirty-one in attendance. The Zoology Section, Dr. Herbert H. Ross, Illinois National History Survey, chairman, heard seven papers and had an attendance of twenty-six persons.

The Social Science and Psychology and Education sections, with Dr. M. R. Goodson, University of Illinois High School, and Dr. V. Dake Jolley, Wheaton College, as co-chairmen, heard four papers and had an attendance of forty-five persons. These sections also held a special noon luncheon, with Dr. Sylvanus M. Duvall, George Williams College, speaking on the subject, "Wanted, A West Point for Peace Leadership," and a morning session on May 8 to view the University of Iowa's motion picture, "The Effects of Social Climate on Behavior," and to discuss implications of this film for classroom management.

The new Collegiate Section of the Academy, which spans the gap between the Junior Academy of Science and the Senior Academy, with Miss Marjory Merrill, senior in biology, and Miss Eleanor Garvin, senior in chemistry, both of MacMurray College, as chairmen, and Dr. H. R. Wanless, University of Illinois, as coordinator, heard a program of fifteen papers presented by college students from five colleges and universities before an attendance of forty persons.

The Physics Section, Dr. O. L. Railsback, Eastern Illinois State Teachers College, chairman, in recognition of the demands made by war on physicists, asked none of its members to prepare papers but, with twenty-five persons in attendance, devoted its time to a discussion of the preparation and certification of science teachers.

The annual banquet of the academy, held on the evening of May 7, was well attended. The short program included the introduction of new officers and, as the outstanding annual highlight, the awarding by the academy of American Association for the Advancement of Science grants in aid of research to Dr. I. A. Koten, Dr. H. J. Eigenbrodt and Dr. C. L. Bieber, jointly, of North Central College, and to Dr. C. W. Bennett, of Western Illinois State Teachers College.

The banquet was followed by the annual public lecture provided by the academy. Dr. Carl T. Russell, head of the department of research and interpretation of the National Park Service, spoke on the national parks during the war and in the future, illustrating his remarks with lantern slides and with a colored motion picture film.

The morning of May 8 was devoted to tours of inspection of the State School for the Blind, State School for the Deaf and State Hospital for the Insane, all of which are located in Jacksonville. At these institutions the managing officers had arranged special demonstrations of methods and displays of equipment and facilities, by means of which the membership of the Illinois Academy might better understand both what is being done towards the rehabilitation of the blind, the deaf and the insane and also how it is being done.

Officers elected for the coming year were:

President: L. J. Thomas, University of Illinois, Urbana.
First Vice-President: A. E. Emerson, University of Chicago, Chicago.
Second Vice-President: H. W. Gould, Northern Illinois State Teachers College, DeKalb.
Secretary: L. R. Tehon, Illinois Natural History Survey, Urbana.
Treasurer: John Voss, Manual Training High School, Peoria.
Librarian: Gilbert Wright, Illinois State Museum, Springfield.
Editor: Grace Needham Oliver, Illinois State Geological Survey, Urbana.
Junior Academy Representatives: Allen R. Moore, J. Sterling Morton High School, Cicero.
Southern Division: Mrs. Mary Creager, Chester High School, Chester.
Delegate to A. A. A. S.: R. F. Paton, University of Illinois, Urbana. Delegate to Conservation Council: V. O. Graham, 4028 Grace Street, Chicago. Publicity Director: Paul Street, Northern Illinois State Teachers College, DeKalb. General Chairman Local Arrangements for 1944: H. W. Gould, Northern Illinois State Teachers College, DeKalb.

Unless unforeseen difficulties arise, the Illinois State Academy of Science will hold its thirty-seventh annual meeting on May 5 and 6, 1944, at DeKalb, Illinois, with the Northern Illinois State Teachers College acting as host. Dr. H. W. Gould, professor of chemistry at that institution, will act as chairman of the committee on local arrangements and already has his committee for the next year's meeting well organized and at work.

L. R. TEHON,
Secretary

SPECIAL ARTICLES

ISOLATION AND PROPERTIES OF CHICKEN ERYTHROCYTE NUCLEI[1]

LASKOWSKI recently has published an improved method for the isolation of undamaged chicken erythrocyte nuclei.[2]. This method is undoubtedly much superior to the previously existing methods, but a disadvantage of the procedure is that lysolecithin must be used, which is not a convenient substance to prepare and which might not be desirable in case lipid studies were to be made with the isolated nuclei.

We have found that if washed chicken erythrocytes are laked in 0.9 per cent. sodium chloride by means of saponin, the nuclei are rapidly liberated and can be readily isolated by centrifugation followed by washing in 0.9 per cent. sodium chloride solution. The concentration of the sodium chloride solution is very important, since for example if one uses 0.85 per cent. instead of 0.9 per cent. sodium chloride, the nuclei almost invariably form a gel as the result of agglutination while they are being washed.

Our procedure was as follows: Fresh chicken blood was collected at the slaughter house and was defibrinated. The erythrocytes were centrifuged and were washed in 0.9 per cent. sodium chloride solution according to the procedure of Laskowski,[2] except that we have washed only twice. Then they were suspended in sufficient 0.9 per cent. sodium chloride solution to make a volume equal to that of the original volume of blood. To one hundred cc of erythrocyte suspensions was added 5 cc of 0.11 molar phosphate buffer of pH 6.8 to 7.0 containing 0.3 gm of Merck's purified saponin. Practically complete laking occurred in five minutes. The nuclei were then washed four or five times with 0.9 per cent. sodium chloride solution. Usually we have added two or three cc of 0.11 molar phosphate buffer of pH 6.8 to 7.0 to the centrifuged nuclei without stirring, immediately before adding the sodium chloride solution.

Nuclei prepared by this method were found to be of even better microscopic appearance than those prepared by us according to the method of Laskowski. However, we used snake venom to prepare our lysolecithin instead of bee venom as employed by Laskowski. Although upon first examination nuclei prepared using lysolecithin or saponin appeared to be free from stroma, heavily stained preparations examined under high power were found to contain a certain amount of extremely tenuous stroma attached to the nuclei. It appears possible that complete removal of this stroma causes agglutination of the nuclei.

The total lipid content of our nuclei is about 14 per cent., of which a considerable fraction appears to be phospholipid. The desoxyribonucleic acid content of the nuclei, determined by the Dische reaction[3] according to the procedure of Seibert[4] is in the neighborhood of 45 per cent.

The respiration of the nuclei without added substrate was compared with the respiration of nuclei prepared by the method of Laskowski,[2] and also with that of nuclei prepared at pH 6.0 by laking with very dilute citric acid. In the latter preparation much stroma appeared to remain attached to the nuclei,

[1] From the Department of Biochemistry and Pharmacology, University of Rochester School of Medicine and Dentistry, Strong Memorial Hospital, Rochester, New York.
[2] M. Laskowski, *Proc. Soc. Exp. Biol. and Med.*, 49: 354, 1942.
[3] Dische, *Z. Mikrochemie*, 8: 4, 1930.
[4] F. B. Seibert, *Jour. Biol. Chem.*, 133: 593, 1940.

making it impossible to wash out the last traces of hemoglobin. The QO_2 values for these preparations are given in Table 1.

TABLE I

	Nuclei prepared using saponin	Nuclei prepared by Laskowski's method	Nuclei prepared by C citric acid method
QO_2 in 0.9% NaCl buffered to pH 7.4 with phosphate, 37.5° C. .	0.40	0.10 ±*	0.10 ±
QO_2 in 0.11 molar phosphate, pH 6.8, 25° C.	0.26	...	...

* Laskowski reports an average value of about 0.20 for the QO_2 of his nuclei, with a variation of 0.15 to 0.22. We have made only one determination in duplicate on Laskowski nuclei and our sample may have stood a trifle too long in the ice box before testing.

Nuclei prepared by our method were rather intensely yellow from a pigment which we believe to be largely xanthophyll. To study this pigment the nuclei were washed once with 95 per cent. alcohol, and this washing was discarded. Then the nuclei were extracted three times with 95 per cent. alcohol and the extracts, which contained nearly all the pigment, were combined. The alcohol was evaporated to dryness, leaving a residue of the pigment together with some lipid. This residue was taken up in a small volume of hot alcohol, and on cooling some of the lipid precipitated and was removed. The concentration of alcohol then was lowered to about 92 to 93 per cent. by the addition of water and the pigment was removed from the alcohol by repeated extractions with petroleum ether. These petroleum ether extracts were combined. Subsequent extraction of the petroleum ether with a small volume of 92 per cent. methanol caused the pigment to pass almost quantitatively from the petroleum ether into the methanol layer. The methanol was evaporated to dryness and the pigment, which still contained some lipid, was taken up in carbon disulfide. The carbon disulfide solution gave absorption bands at 444.5, 476.0 and 507.5 mμ, which coincide almost exactly with the positions of bands reported in the literature for xanthophyll.[5] The pigment gave two observable bands in petroleum ether at 444.0 and 475.5 mμ, and in 92 per cent. methanol two bands at 448.0 and 478.0 mμ could be seen. A sample of the pigment that had been evaporated to dryness gave a strong blue color with the Carr-Price reagent.

Although the original alcoholic extract containing the yellow pigment showed practically no fluorescence, a sample of nuclei in which the xanthophyll had gradually disappeared during storage yielded, after drying, a light yellow ether-alcohol extract which was appreciably fluorescent, possibly indicating a flavin pigment.

When the isolated nuclei were suspended in distilled water and the pH was adjusted to about 8.5 with ammonia, a transparent apparently structureless gel was formed which persisted in extreme dilutions. The transparency of this gel is of interest in view of the considerable amount of lipid present. The gel is coagulated to form a rather fibrous precipitate by the addition of a little dilute acetic acid. A similar gel is also formed if 5 or 10 per cent. sodium chloride is added to the centrifuged nuclei, and Laskowski states that saturated sodium chloride solution also causes gel formation. It appears likely that the gel must represent some sort of heavily hydrated lipo-nucleoprotein complex with the lipid in a fairly high degree of dispersion.

SUMMARY

(1) A method has been described for the isolation of chicken erythrocyte nuclei using saponin to lake the cells. Nuclei prepared by this method have been compared with nuclei prepared by the method of Laskowski[2] and with nuclei prepared by a citric acid method, particularly in regard to respiration.

(2) The total lipid content of the nuclei is about 14 per cent. and the desoxyribonucleic acid content is about 45 per cent.

(3) A yellow pigment contained in the nuclei appears to be xanthophyll.

(4) A gel formed by the nuclei at pH 8.5 in the presence of ammonia and the absence of other cations is described.

This work was supported by the International Cancer Research Foundation, of Philadelphia, Pa.

ALEXANDER L. DOUNCE
TIEN HO LAN

[5] H. Gilman, "Organic Chemistry, An Advanced Treatise," Vol. II, page 1149. New York: John Wiley and Sons, 1938.

FRACTIONAL CEPHALIN–CHOLESTEROL FLOCCULATION IN HEPATIC DISEASE[1]

SINCE 1938, when Hanger[2] first described the ability of sera from patients with intrahepatic disease to flocculate an emulsion of cephalin and cholesterol, a number of reports have appeared in the literature (summarized in a recent contribution from this institution[3]) indicating the validity of this laboratory procedure as an aid in the study of disorders of the liver. This test has proved to be of particular value in the differentiation between hepatogenous jaundice and

[1] From the Medical Research Laboratory and the Division of Pathological Chemistry, New York Post-Graduate Medical School and Hospital, Columbia University, New York.

[2] F. M. Hanger, *Trans. Asn. Am. Physicians*, 53: 148, 1938; *Jour. Clin. Invest.*, 18: 261, 1939.

[3] C. H. Greene and M. Bruger, *N. Y. State Jour. Med.*, 43: 318, 1943.

early obstructive jaundice (*i.e.*, before damage to the hepatic cells has occurred).

The cephalin-cholesterol flocculation test as originally described, however, fails to provide adequate margin for the study of alterations in the degree of damage to the hepatic cells. The purpose of this preliminary report is to show that the degree of cephalin-cholesterol flocculation produced by the addition of various concentrations of serum, when carried out at intervals, may be used as an index of increasing or decreasing hepato-cellular pathology.

The cephalin-cholesterol emulsion[4] was prepared according to the procedure originally described by Hanger.[2] Five chemically clean test-tubes (10 ml capacity) were set up each containing 4 ml of 0.9 per cent. NaCl and 1 ml of the diluted lipid emulsion. To Tube I was added 0.1 ml of the patient's serum and the contents mixed. Decreasing concentrations of serum were then prepared according to the following schedule:

Dilution 1.—0.1 ml of serum diluted with 0.9 ml of 0.9% NaCl.

Dilution 2.—0.1 ml of Dilution 1 diluted with 0.9 ml of 0.9% NaCl.

Dilution 3.—0.1 ml of Dilution 2 diluted with 0.9 ml of 0.9% NaCl.

Dilution 4.—0.1 ml of Dilution 3 diluted with 0.9 ml of 0.9% NaCl.

To Tubes II, III, IV and V were added 0.1 ml of Dilutions 1, 2, 3 and 4, respectively. The tubes were placed in a rack and kept at room temperature for 24 hours. The degree of flocculation of the cephalin-cholesterol emulsion was then read and graded from 0 to ++++, the former indicating no flocculation and the latter complete clearing of the supernatant fluid.

The table shows the results obtained in two of seven patients with simple (catarrhal) jaundice. In Case I. F., fractional cephalin-cholesterol flocculation tests carried out at intervals indicated increasing hepatic damage from the day of admission to the hospital until the 34th day when the icterus index reached 188 units. Clinical improvement was evident on the 48th hospital day when flocculation failed to occur in Tubes IV and V. In this patient, the extent of fractional flocculation appeared to vary directly with the icterus index. In Case D. C., clinical improvement was accompanied by decreased to absent flocculation in the high dilutions; of interest was the lag observed in the diminishing cephalin-cholesterol flocculation compared to the decided decrease in the icterus index on the 28th hospital day. This is not unlike the lag in the return of the erythrocyte sedimentation rate to normal commonly encountered in patients recovering from acute rheumatic fever.

[4] In these studies, the cephalin-cholesterol antigen prepared by the Difco Laboratories, Detroit, Michigan, was used.

TABLE I

FRACTIONAL CEPHALIN-CHOLESTEROL FLOCCULATION IN TWO PATIENTS WITH SIMPLE (CATARRHAL) JAUNDICE

Days	Cephalin-Cholesterol Flocculation					Icterus Index
	Tube I (0.1 ml serum)	Tube II (0.01 ml serum)	Tube III (0.001 ml serum)	Tube IV (0.0001 ml serum)	Tube V (0.00001 ml serum)	
	Case I. F. Female, age 45 years					
0	++++	++++	+++	0	0	94
11	++++	++++	+++	0	0	125
17	++++	++++	+++	++	0	150
34	++++	++++	+++	+	+	188
42	+++	+++	++	+	+	150
48	+++	+++	+	0	0	107
	Case D. C. Female, age 46 years					
0	++++	+++	+++	++	0	125
28	++++	+++	+++	+	0	21
49	+++	+++	++	0	0	13

Summary: The fractional cephalin-cholesterol flocculation test appears to be a valid procedure for following alterations in the degree of hepato-cellular damage in patients with diseases of the liver. When carried out at intervals, the fractional test permits the evaluation of injury to the hepatic cells in terms of increasing or decreasing pathology.

MAURICE BRUGER

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STUDIES ON PERIPHERAL VISUAL ACUITY

ALTHOUGH peripheral visual acuity curves are well known, there has been very little work done to determine normal variability or to correlate this acuity with other visual functions. Certain wartime accidents under combat conditions have indicated that faulty peripheral acuity, unknown to the individual, may have been responsible. This prompted the writer to develop a reasonably short, accurate test of this visual function and to investigate the possibility of improving it by systematic training. A brief report is presented herewith.

Peripheral visual acuity (or efficiency) was measured by the use of Landolt broken circles with breaks of the following sizes; .5, 1, 1.5, 2, 2.5, 3, 4, 5, 6, 7, 8, 9 and 10 mm, fitted to a carrier mounted on a 25 cm perimeter. Illumination was kept constant with a built-on illuminator, the light from a 60-watt Mazda daylight lamp 35 cm from the test object being incident at 45°. Surrounds and operator were blacked out. Nine points on each eye, 30°, 60° and 90° from the line of vision, were tested with the other eye blacked out. The test object was covered with a black paddle and then revealed successively in any of four possible positions corresponding to points of the compass (N, S, E or W), the subject signaling the position with the eye fixed forward. Four consecutive successful identifications were necessary for a score. The

size of the break in the smallest circle successfully identified was scored, the sum of 14 points being the total score. The 90° points were generally too weak to have scoring value. The reciprocal of the total score was used for percentage determinations. One hundred subjects selected at random were tested to determine the norm. The average of all scores was arbitrarily chosen as 100 per cent. On this basis 87 males scored 102 per cent. and 13 females 91 per cent. The best subject scored 364 per cent. and the worst 43 per cent. The peripheral acuity thus measured was found to be an independent factor: it did not correlate accurately with age, sex, central acuity or color vision. There was a positive correlation with central acuity of .39, yielding no practical reciprocal predictive value. Although the youngest group was the best, the peripheral acuity did not decline steadily with age. The oldest of four groups (40–70 years) was the second best age group. Eight color-blind individuals scored an average of 92 per cent. The test showed a .91 reliability.

Of the original group of one hundred, 30 were males from 18 to 27 years of age inclusive, who had normal or better central vision, normal color vision and no astigmatism; the requirements for aviation cadets. Their average score was 115 per cent., the best scoring 210 per cent. and the worst 52 per cent. These latter two represented the 2nd and 99th in degree of peripheral acuity of the original group of 100.

A shortened version of the test taking from 12 to 14 minutes (as compared to from 40 to 60 minutes for the original) was run on another group of 113 subjects and was repeated in from 8 to 10 weeks. The second scores showed an average of 6 per cent. improvement. Twenty of the original group of 100 were retested and showed an average of 16 per cent. improvement. The improvement was roughly proportional to the amount of time taken by the test. In two test groups out of three the second eye tested better than the first.

This investigation has revealed great spontaneous variability in peripheral visual acuity, incidentally always without the individual's awareness. It shows such acuity to be an independent visual factor. The evidence indicates that peripheral visual acuity can be trained. Experiments in testing, training and correlation are being continued.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A MACROCHEMICAL REACTION FOR THE DETECTION OF PEACH MOSAIC[1]

SINCE the beginning of the program for the eradication of peach mosaic in western Colorado, difficulties have been encountered in the detection of symptoms of the disease in certain horticultural varieties of peach which did not show constant symptom manifestations.[2, 3] Because of these difficulties, the possibility of using a differential color reaction as a supplementary aid in the detection of the malady was investigated. Hutchins[4] in 1933 was the first to use a chemical color reaction as an aid in the identification of a virus disease of peach, the phony disease. Rawlins and Thomas[5] described a microchemical reaction for another virus disease present in peach, the buckskin disease of cherry and other stone fruits.

The Elberta peach variety was used for the test herein described because it showed symptom manifestations of the strains of the peach mosaic virus[6] throughout the entire growing season. The Elberta trees used were grown upon "natural" peach seedling rootstocks. The thinnest possible complete free-hand sections about $\frac{1}{4}$ inch in diameter were cut from healthy and diseased roots and stems. Sections were placed in a watch glass and a drop of a saturated solution of phloroglucinol in 100 per cent. methyl alcohol was added to each section. After this solution evaporated to dryness, a drop of a solution of nitrophenolic acid in methyl alcohol was placed on each section and allowed to evaporate to dryness. This solution was prepared as follows: Fifty ml of concentrated nitric acid were added to $\frac{1}{2}$ gram of C.P. phenol and allowed to stand over night. An equal volume of water was added the following day and the solution allowed to stand for about 18 hours. Three drops of this solution were placed in 25 ml of 100 per cent. methyl alcohol.

Differentiating color reactions were found to be characteristic of the xylem of sections from healthy trees and from trees infected with the severe and medium strains of the peach mosaic virus. Healthy stem and root portions turned a color varying between Persian lilac and Daphne pink,[7] while virus-infected seedling rootstocks and stems of Elberta

[1] Scientific Series Paper No. 155.
[2] E. W. Bodine and L. W. Durrell, *Phytopath.*, 31: 322–333, 1941.
[3] L. M. Hutchins, E. W. Bodine and H. H. Thornberry, *U. S. Dept. Agr. Circ.* No. 427, 1937.
[4] L. M. Hutchins, *Ga. State Ent. Bull.*, 78, 1933.
[5] T. E. Rawlins and H. Earl Thomas, *Phytopath.*, 31: 916–925, 1941.
[6] E. W. Bodine and L. W. Durrell, *Phytopath.*, 31: 4, 1941.
[7] R. Ridgway, "Color Standards and Nomenclature." 43 pp. 53 colored plates. Washington, 1912.

ranged in color from maize yellow to apricot yellow. Color reactions showed greatest contrast when materials were collected in the fall and early spring and tested immediately. They were not distinctive when tests were made during the active growing season. Sections from peach trees affected with other virus diseases, namely the Golden net and the "X" disease, showed no differential coloring.

Further studies are in progress to determine the effectiveness of the reaction in the detection of the disease in seedling rootstocks onto which other peach varieties are commonly budded.

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A METHOD FOR NARCOTIZING HOLOTHURIANS

AT the Marine Biological Laboratory, Woods Hole, various methods have been tried for narcotizing *Thyone briareus*. These sea cucumbers are widely used in invertebrate zoology courses throughout the country, either as live material when available along the Atlantic coast or as preserved specimens further inland. It is highly desirable to find a method of expanding these animals without the waste of a high percentage of the specimens in the treatment.

The Supply Department at Woods Hole has, for many years, obtained expanded specimens of holothurians by treating them in the field. The undisturbed animal with extended tentacles is quickly grasped back of the tentacles before it has time to retract. The oral end is then immediately dipped into a solution of nitric acid and paralyzed. The specimen is then placed directly into a formalin solution. This method is cumbersome and requires much time, especially since *Thyone* is not nearly as common as it once was in the area. It is not at all practical to use this method on the sea cucumbers brought into the laboratory, since only a small per cent. of the animals will normally extend the tentacles in the aquarium.

Dr. T. H. Bissonnette, Trinity College, advised me that a saturated solution of chloretone in sea water had been used during the past few summers in preparing *Thyone* for class use. Fifteen cc of the solution were injected into the coelom of each animal. He also stated that the method was unsatisfactory; many of the specimens did not relax.

During the summer of 1942 while instructing in the invertebrate course at Woods Hole I tried several methods of anesthetizing *Thyone* without success. Several attempts were made, using the saturated chloretone solution for injection and immersion. The animals remained turgid several hours after this treatment. A saturated solution of magnesium sulphate was tried since I had earlier achieved some success in narcotizing the California sea cucumber, *Stichopus*, with this chemical. *Thyone* did not relax when submerged in the solution nor when injected with it.

Ledingham and Wells[1] have successfully narcotized marine annelids with magnesium chloride solution. They used 80 grams of crystalline magnesium chloride dissolved in 1,000 cc of tap water, and immersed the annelids in the solution for a period of 1 to 4 hours for relaxation. I tried the same solution on *Thyone*. The animals remained turgid after being immersed for 12 hours.

The same solution was used as an injection into the coelomic cavity and was successful in 100 per cent. of the trials. Each specimen was injected with approximately 15 cc of the solution and then submerged in a vessel containing the same solution. A relatively fine hypodermic needle should be used since a part of the intestine often escapes through a hole in the body wall made with a coarse needle. The injected animal becomes very turgid for about 15 minutes and then gradually relaxes. After one hour some of the specimens will extend the tentacles without manipulation. In the others the tentacles may be worked out easily by suspending the animal from the aboral end and applying pressure to the bulb of fluid thus formed. Over 100 *Thyone* were relaxed in this manner. About half of them were animals which were regenerating after having evicerated about a month previous to the date of relaxation.

Three of the narcotized sea cucumbers were placed in running sea water and had regained their turgidity after about 48 hours. Time was not available for a longer observation.

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TEXAS CHRISTIAN UNIVERSITY

[1] Isabel C. Ledingham and G. P. Wells, *Nature*, 150: 121, 1942.

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SCIENCE NEWS

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SCIENCE IN 1942

CHEMISTRY AND PHYSICS

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ELECTRON accelerator, whirling electrons up to 20,000,000 volts and producing x-rays of like power was completed, and a similar 100,000,000-volt machine is being built. A direct current x-ray generator operating at a potential more than 4,000,000 volts was developed.

An x-ray microscope has been devised which, by a photographic process, converts the usual diffraction pattern of a crystal into an actual picture of the arrangements of the atoms in one plane of the crystal.

New electron spectrometer, utilizing the varied slowing up of electrons passing through a specimen, produces a "spectrum" which aids in identifying the material, and supplements the electron microscope examination.

New ultra-fast oscillograph, with a beam sweeping at 18,000 miles per second, and timing to a few billionths of a second, records the wave form of transients, lightning flashes, and other oscillatory discharges up to 113 megacycles.

New scanning electron microscope makes use of television principles to examine opaque objects (not possible in the ordinary electron microscope), and reproduces the picture on a telegraphic facsimile printer.

An adapter has been devised which converts the ordinary electron microscope into a diffraction camera, so that in addition to the usual electron picture, the crystal or molecular structure of the specimen may also be determined.

Desk-size electron microscopes were developed, having simplified operation and much lower cost.

Chemical element 61, illinium, which does not occur in nature, was produced artificially by atomic bombardment with the cyclotron, but quickly disappeared by radioactive disintegration.

New measurements of the "proper" life of the mesotron gave it 2.8 millionths of a second in place of 1.6 millionths of a second previously estimated.

The proposal has been made to use the freezing point of benzoic acid, 122.37 degrees centigrade, for the standardization of thermometers.

Neutron pictures to supplement x-ray pictures showed certain advantages; neutrons were also employed in geophysical prospecting.

Synthetic cellulose was made for the first time.

Hydrogen fluoride was found to be a catalyst superior to aluminum chloride in the manufacture of synthetic rubber and of 100-octane gasoline.

Methods were found for making many kinds of oil out of any vegetable or animal fat.

By the use of fusel oil, alcohol was made from agricultural and industrial wastes without the expensive distillation process.

New solvents of the nitroparaffin class were developed for paints, lacquers and varnishes.

A solution of potassium, copper and arsenic salts has been found an effective means of retarding decay in telephone poles.

Color photography at night from high flying airplanes has been made possible by special filters and brilliant flash bombs of colored light.

Synthetic chewing gum was produced to replace chicle from tropical America.

Bread molds were found superior to malt in alcoholic fermentation.

ASTRONOMY

The first planet outside our own solar system was discovered, a satellite of an obscure double star in Cygnus, that is a sixtieth the mass of the sun and about 16 times the mass of Jupiter.

The brightest nova since 1918, Nova Puppis, rose to brilliance greater than first magnitude.

A remnant of Kepler's famous nova of 1604 was discovered as a small fan-shaped cloud.

A "Saturn" star, an intensely hot body surrounded by a luminous gas ring four times the diameter of our sun, was discovered.

S Doradus, a star 600,000 times brighter than our sun, was shown to be a double star, with each twin a giant.

Three or four mysterious spectral lines in starlight were explained by assuming that a substance impossible on earth, CH, or hydrogen carbide, exists in the so-called "empty" space between stars.

The mass of the moon was determined anew, this latest value making it 1/81.271 of the earth's mass.

A new "window" in the atmosphere was discovered when the observable spectrum in the infra-red region was extended to 24 mu.

The most powerful magnetic field measured in a group of sun-spots was recorded for the group visible to the unaided eye February 25 to March 1.

The reddest star ever photographed was discovered in the constellation of Monoceros.

A nova or exploding star was discovered in the constellation of Cygnus.

New comets discovered were Whipple, Oterma I, Oterma II.

New comets rediscovered were: Grigg-Skjellerup, Forbes, Schwassmann-Wachmann I, Wolf I.

A military version of the Schmidt camera-telescope went into war service as an aerial camera.

Pronunciations of constellations, stars, planets, etc., were standardized.

War time was adopted February 9 when all civil clocks were advanced an hour.

EARTH SCIENCES

In order to deprive the enemy of weather information, daily maps and forecasts were suspended by the U. S. Weather Bureau for the duration.

There were 40 earthquakes of sufficient strength to record themselves on distant seismograph instruments;

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notable among them was a "family" of nine shocks in Ecuador at the beginning of July.

A gas well yielding pure nitrogen surprised its drillers in Wyoming.

A new device for sorting valuable particles out of low-grade tin ores and other minerals was developed.

Large-scale tests of sponge-iron production were undertaken in order to relieve scrap shortage in steel production.

A robot weather station, suitable for installing on mountaintops or uninhabited islands, was invented.

An unprecedentedly wet season kept some central areas of the country soggy during much of the summer, and caused some floods.

There were several severe tornadoes; one of them, in the Ozarks, killed 28, injured 200.

A storm-caused tidal wave near Calcutta drowned more than 10,000 persons.

No tropical storms of full hurricane strength reached the United States from the Carribean-Gulf region.

A new branch of geological science made its bow: paleogrostology, the study of fossil grasses.

An outflow of lava from Mauna Loa menaced the city of Hilo, but stopped before doing damage.

Biological Science

Crops of corn, wheat, soybeans and several other products broke all records, despite menacing farm labor shortages and early frosts.

An American scientific mission went to China to aid in improving agriculture and soil conservation there.

There was lively interchange of scientific personnel and information between U. S. A. and Latin-American agriculture.

The U. S. A. and Britain offered aid to the USSR in reconstructing agriculture in the "scorched earth" regions after the war.

Search for new sources of natural rubber included enormous expansion of guayule acreage, importation of hundreds of pounds of kok-sagyz seed from the USSR, efforts to organize collections of wild rubber in South and Central America, and planting selected seedling and grafted trees in the same tropical regions.

The four great regional laboratories of the U. S. Department of Agriculture concentrated efforts on war problems.

Day-and-night changes in temperature were found necessary for the production of fruit and seed by plants.

Tobacco mosaic virus kept 28 years in a bottle was found still able to produce disease.

The country-wide Victory Gardens movement was successfully carried through.

Domestic production was undertaken in many crops hitherto imported: hemp and other fibers, cork oak, drug plants, flavoring herbs, etc.

The number of plant patents passed 500.

Mechanization of beet sugar production was advanced by invention of a machine for planting treated seed, and of another to top harvested beets; both previously hand work.

Many new insecticides, both natural and synthetic, were tried, in search for substitutes for previously imported pyrethrum and rotenone.

A substitute for tapioca, both for food and "stickum" for stamps, was found in "Leoti" sorghum seed.

Thousands of sea birds became U-boat victims, killed by oil released from torpedoed ships.

Archeology, Anthropology

New Stone Age implements were found in the famous cave on Mt. Carmel in Palestine where only Old Stone Age records had previously been known, thus closing a long gap in the site's pre-history.

Cannibals and head-hunters in some South Sea islands reverted to old practices, due to removal of governmental controls and missionary influences by Jap invasion.

Despite a wartime spurt in the birth rate, the population of the United States is becoming stationary, statistical studies indicated.

No human artifacts were uncovered along the whole length of the new Alaskan Highway.

The smallest known normal human skull was found in an ancient cemetery in coastal Peru.

Psychology and Psychiatry

The number of brain cells in baby rats was increased artificially by injecting the mothers with pituitary growth hormones before the birth of the young, but their ability to learn was not increased.

A test for color aptitude has been prepared for evaluating workers in industries requiring accurate discrimination of small color difference.

Experiments showed that a change in the pitch of sound may be heard although there has been no shift in the point of maximal stimulation on the basilar membrane of the cochlea.

By stimulation of the eye with a barely perceptible electric current, it is possible to distinguish between blindness due to disease of the eye's retina and blindness caused by disease of the nerve.

Brain wave rhythms which are blocked out when the eyes see light can be used to detect cases of faked complete blindness.

By leaving intact a tiny isolated blob of pituitary gland and hypothalamus to maintain the water and sugar balance of the body, it was possible to discover that animals lacking 95 per cent. of the brain can walk, jump, claw and right themselves.

A single application of alum to the motor area of the brain made animals subject to repeated epileptic-like seizures when exposed to loud noise, apparently by permanent alteration of the brain cells.

Brain injuries resulting in spastic paralysis do not result in any characteristic personality traits, survey of 123 child patients revealed.

The character of brain activity, which changes with increasing age during the period of growth, was observed to continue to change toward the fast end of the brain frequency spectrum during adult life.

A monkey was taught to distinguish objects on the basis of such qualities as mobility and color, demonstrating a capability for this kind of abstract thinking.

(To be continued)

ANNOUNCING

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SCIENCE NEWS

Science Service, Washington, D. C.

SCIENCE IN 1942

PSYCHOLOGY AND PSYCHIATRY

(Continued from p. 10, January 1)

Rats so sensitive to noise that they would be thrown into fits by a shrill sound were made immune for days to such sounds by a two-week treatment in which the fit-producing noises were preceded by harmless sounds.

A muscle of the ear, the stapedius muscle, was found to serve as an automatic damping agent to protect the inner ear against excessive noise—perhaps partly explaining why loud noise temporarily deafens.

Airsickness and other types of motion sickness, although originally due to action of the balancing mechanism in the inner ear, is often the result of conditioning to other sights, smells and motions, and if so can often be prevented and cured by psychological means.

Some cases of weakness in distinguishing colors can be relieved by doses of vitamin A.

Individuals who have recently received doses of the sulfa drugs may make wrong decisions because of mental confusion that sometimes persists after this treatment.

The bizarre craving to eat dirt may be caused by diet deficiency rather than mental illness is shown in a survey of the diet of school children.

Radio in the farm districts increases the contentment of those who are well-adjusted to farm life, and increases discontent among the ill-adjusted.

Hallucinations can be produced in normal individuals by the simple form of learning known as conditioning.

The traumatic neurosis of this war, seemingly more severe than the "shell shock" of last time, is expected to take more physical forms such as peptic ulcers and heart complaints, with less functional paralysis; effective treatment combines hypnosis or hypnotic drugs with psychoanalytic methods.

Evidence that the way insulin shock treatment aids the metally ill is by making them forget recently acquired abnormal ideas and behavior was furnished by experiments in which newly acquired learning was forgotten after insulin treatment while older, more thoroughly drilled habits were retained. Similar results were obtained in human schizophrenic patients treated with metrazol shocks.

Sub-shock doses of electric current through the brain were found to shorten the duration of delirium tremens following prolonged alcoholism.

Pneumoencephalography, invaluable in the location of intracranial tumors, was proved to be prognostically misleading in cases of so-called cerebral atrophy; in spite of x-ray evidence of atrophy, behavior development was found to proceed normally.

ENGINEERING AND TECHNOLOGY

Puffed up sand, known as silica aerogel, was introduced as a heat insulator twice as effective as any other substance.

Glass that floats in water and replaces cork, balsa, cellular rubber or kapok in life preservers and life rafts, was made by foaming glass with carbon additions during manufacture.

A continuous fermentation process was developed to convert molasses into alcohol in three to five hours.

A method of heat treating iron or steel in inert atmosphere or vacuum furnace was demonstrated to remove or prevent scale formation.

Plastic coatings were used to replace tin upon cans for many uses, including food packing.

Non-metallic containers of various sorts were introduced to replace tin cans in many industrial uses.

A new electroplating process saved half the tin that goes into a tin can and saved electric power and half the time of plating.

Steam acidified with gluconic acid was used to clean milk cans more quickly.

Induction heating furnaces, operated by electron tubes, were used to coat and flow tin on iron sheet in tin plating process.

A new plastic that can be kneaded and thrust into leaks in life boats was put into use.

Foods, such as lard, were made to refrigerate perishable goods on overseas journeys by being chilled to sub-zero temperatures and placed about the foodstuffs to be kept chilled.

Soldier's V-mail was transported overseas as microfilm and photographically enlarged for delivery.

Heavily coking bituminous coals were successfully burned in household furnaces by use of improved underfed stokers.

Synthetic glass jewels were made in America for pivot bearings of small instruments.

Iron was substituted for printing plates of nickel and copper in experiments.

Chemically toughened wool, resistant to moths and soap, was developed.

A new inflatable rubber pontoon was substituted for the standard aluminum boat for temporary bridges formerly used by the Army, saving rubber by reducing the truck transport needed.

A "pancake" Diesel engine for Navy subchasers was announced as in production.

A wire "umbrella" was developed to protect explosives plants and oil storage from lightning.

Cellulose acetate now completely replaces silk as an insulation for telephone wires with considerable improvement.

Transoceanic telephone cables now seem to be practicable due to the invention of a telephone repeater which can be built into the cable structure itself.

Method of wiping lead joints on telephone cables was brought into use, which saves about 60 per cent. of the usual requirements of tin.

A method of producing x-ray photographs that show three dimensions on a single film was demonstrated.

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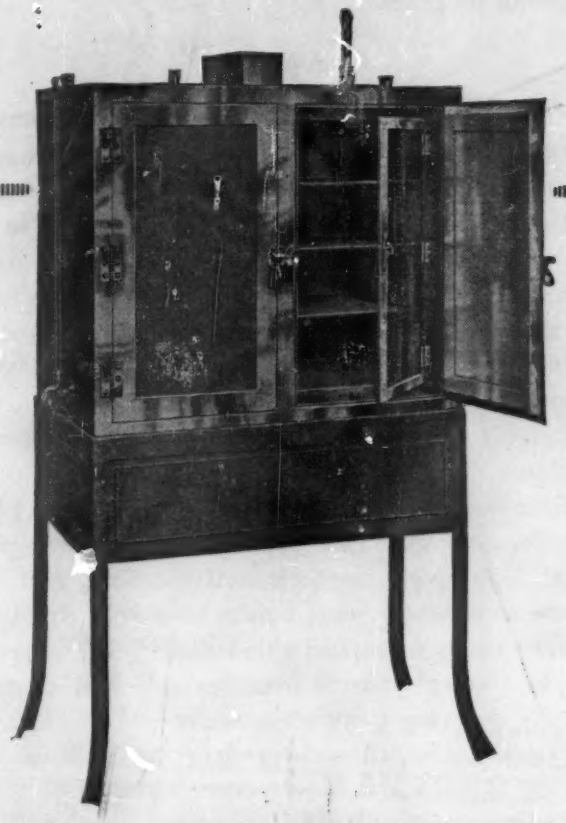

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Merchant shipbuilding facilities were expanded to the point where there are more than 60 yards, with 300 ways and nearly 2,000,000 workers, producing 8,000,000 tons of shipping in 1942.

Cargo ships of 10,500 tons were completed from keel laying to launching in 4¾ days and from launching to delivery in eight days.

Side-launching of ships was used extensively in war shipbuilding program.

AERONAUTICS

Solution of certain research problems—development of new low-drag wing sections, improvement of flaps, improvement of cooling systems, improved engines and new propeller designs—made it possible for America to build planes to fly faster than 400 miles per hour.

Cylinder heads made by forging in a die, with fins cut on the exterior by a high-speed milling machine, made possible reduction in weight of airplane engines to less than one pound per horsepower.

A portable catapult was developed for land launching of airplanes.

Modification of battle-tested airplanes made possible the development of a new technique of air warfare—low flight at high speed for horizontal bombing, and use of the plane as a fighter when bombs have been dropped.

Inboard bomb racks for wide-hulled flying boats, with guides to "steer" bombs over the side and start them accurately downward, were invented.

Auxiliary turbo-driven propellers for getting rocket planes up through the denser lower atmosphere were invented; they are powered by the rocket blast, and are to be jettisoned once the plant has reached the stratosphere.

New multi-engined transition training planes for instruction of flight crews were developed and put in use.

Pre-flight aviation training was introduced as a regular part of the curriculum in elementary and secondary schools.

A new telescopic sight for rear gunners made possible wider arc of fire and better streamlining of the fuselage.

Apparatus for automatic control of the pressure within a sealed airplane cabin by blowing off to outside air when pressure is high and turning on a supercharger when it falls, was invented.

A cooling meter for aircraft engine cooling, and meters for measuring the visibility of exhaust gases from airplane engines were developed.

A de-icer for airplane propellers that provides for the forcing of anti-freeze chemical through a series of holes when the propeller is rotated, was patented.

A device was developed that warns the pilot of approaching stall conditions by means of a tube which transmits pressure changes from the trailing edge of the wing to a diaphragm within the wing connected with an electric instrument.

Caterpillar-type treads for airplane landing gear were invented.

A new ordnance mount for machine guns, combined with gunner's seat mounted on a circular track, was developed for enabling the gunner to swing himself and his weapon around to fire at any angle and if necessary to pilot the plane.

MEDICAL SCIENCES

Lowest death rate in the history of the United States death registration area and an all-time record low in smallpox cases, recorded in 1941, were reported, after an interval for collection of figures, in 1942.

For the first time in medical history, disease-fighting substances in the blood known as antibodies were formed artificially in laboratory flasks, confirming the theory of molecular changes in immunization.

First direct evidence of human need for certain amino acids in protein foods was discovered in diet studies with human volunteers which showed that arginine is required for spermatogenesis, lysine plays a role in the female reproductive cycle, and tryptophane is also essential, lack of it leading in rats and possibly also in humans to baldness and sex gland atrophy in males and to teeth defects and cataracts in young, growing animals.

First, and strikingly successful, use of the Moorhead Foreign-Body Finder, which uses a radio frequency circuit with movable coil and steel finger to detect shell fragments and the like in war wounds within a few minutes instead of hours as by X-ray and probe, was reported from Pearl Harbor.

Efficient U. S. Army system of evacuating the wounded under fire, sulfanilamide and blood plasma banks scored a notable triumph in saving lives at the Pearl Harbor raid, where almost 100 per cent. of abdominal wounds healed without infection, less than 4 per cent. of compound fractures and flesh injuries became infected.

Propylene glycol vapor was found to be a safe, effective substance for destroying influenza virus and other germs in the air in laboratory experiments and was credited with reducing significantly respiratory infections among 16 children in the ward of an institution where it was tried.

Experimental use of a 10-hour combined chemical and fever treatment of syphilis and, on a wider scale, of six to ten-week intensive chemical treatments were announced.

Discovery that ants are capable of spreading dysentery was announced.

Discovery of chemicals, probably enzymes, in the bodies of young mice which destroy the drug-resistant waxy parts of the tuberculosis germ were announced with some hope of development of an enzyme preparation that might be used in the treatment of tuberculosis.

Hope for a chemical conquest of tuberculosis was encouraged by announcement of successful results in treatment of patients with a relatively new drug, Promin, and by announcement of even greater success in treatment of tuberculous animals with a related chemical, di-amino-diphenyl sulfone.

Reduction of venereal disease in the Army to a rate of 38.2 per 1,000 for the first six months of 1942, with a syphilis rate the lowest in Army history, was accomplished following establishment in the Surgeon General's office of a division of venereal disease control with officers assigned to each large Army camp and each of the larger tactical units.

(To be concluded)

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SCIENCE NEWS

Science Service, Washington, D. C.

THE ECLIPSE OF THE SUN

THE moon will blot out the sun on Thursday, February 4, along what might be a bomber's route between Alaska and Japan. But it is a safe bet that this will be the one total solar eclipse of the century that no very serious astronomical expedition will be observing.

For one thing, most of the choice points in the band of temporary total darkness are at sea where there is no stable base for telescopes. The main difficulty is that there is a war on. Astronomers in normal times might be tempted to take a run up to Anchorage, Alaska, where the totality lasts 48 seconds shortly before sunset that day. They might be interested in rechecking upon the Einstein gravitational effect that bends starlight passing by the sun. Or they might photograph the corona, the sun's halo. Just now many astronomers are busy with ballistics, navigation, making military telescopic cameras or other such important war jobs.

Soldiers, sailors and airmen will pause a few minutes in their fighting and work to see the glory of a total eclipse, the clouds and fog of the Alaskan winter permitting. The moon's shadow will touch earth in Manchuria at sunrise on February 5. The eclipse will begin a day before it ends, by the calendar, because it crosses the international date line in its sweep across the Pacific. After crossing the Sea of Japan, passing across the Japanese island of Hokkaido, it travels swiftly across the ocean. After running south of the Andreanoff Islands, the shadow will go just south of Dutch Harbor, darken part of Kodiak Island and cross Alaska on its way to leave the earth in the northern part of the Canadian Yukon at sunset.

The sun will be seen partially eclipsed throughout Alaska, along the west coast regions of Canada and the United States and Hawaii.

As the Chaldean astronomers first discovered, eclipses recur at intervals of 6,585 ⅓ days, known as a saros. This figures back to January 24, 1925, when a total sun's eclipse was seen by astronomers and public alike under good conditions in New York, southern New England, as well as farther west.

As consolation for missing the February 4 eclipse, astronomers will have to look forward to the next eclipse to come within possible reach. On July 9, 1945, there will be a total solar eclipse beginning near Boise, Idaho, traveling northeastward through Montana, Saskatchewan, Manitoba, across Hudson's Bay to Greenland and on into Europe and Asia. Perhaps astronomers can conduct victory expeditions to observe this astronomical event, transported by bombers that will be through with carrying out other missions.—WATSON DAVIS.

SIGMA XI LECTURES

TEN quadrillions of stars: 10,000,000,000,000,000. That's the modest census of the part of the universe within photographing range of our largest existing telescopes, with which Professor Harlow Shapley, director of Harvard College Observatory and vice-president of Science Service, concludes the opening chapter of a new "symposed" book, Science in Progress, published by the Yale University Press.

The ten chapters in the book were edited from lectures presented by ten leading American scientists, on tour over the country under the auspices of the Society of the Sigma Xi. Assembling them into book form was the work of Professor George A. Baitsell, of Yale University, secretary of the society. They present the highlights of some recent developments in astronomical, physico-chemical and biological sciences. The volume has been made a science book-of-the-month by the Science Book Club.

Professor Shapley bases his staggering figure on a conservative estimate of the number of stars in our own galaxy, the Milky Way system—about a thousand millions of them. In the sphere of space which present telescopes can reach there are at least ten million more like it. Ten million times a thousand million multiplies out to ten quadrillion—if that number means anything.

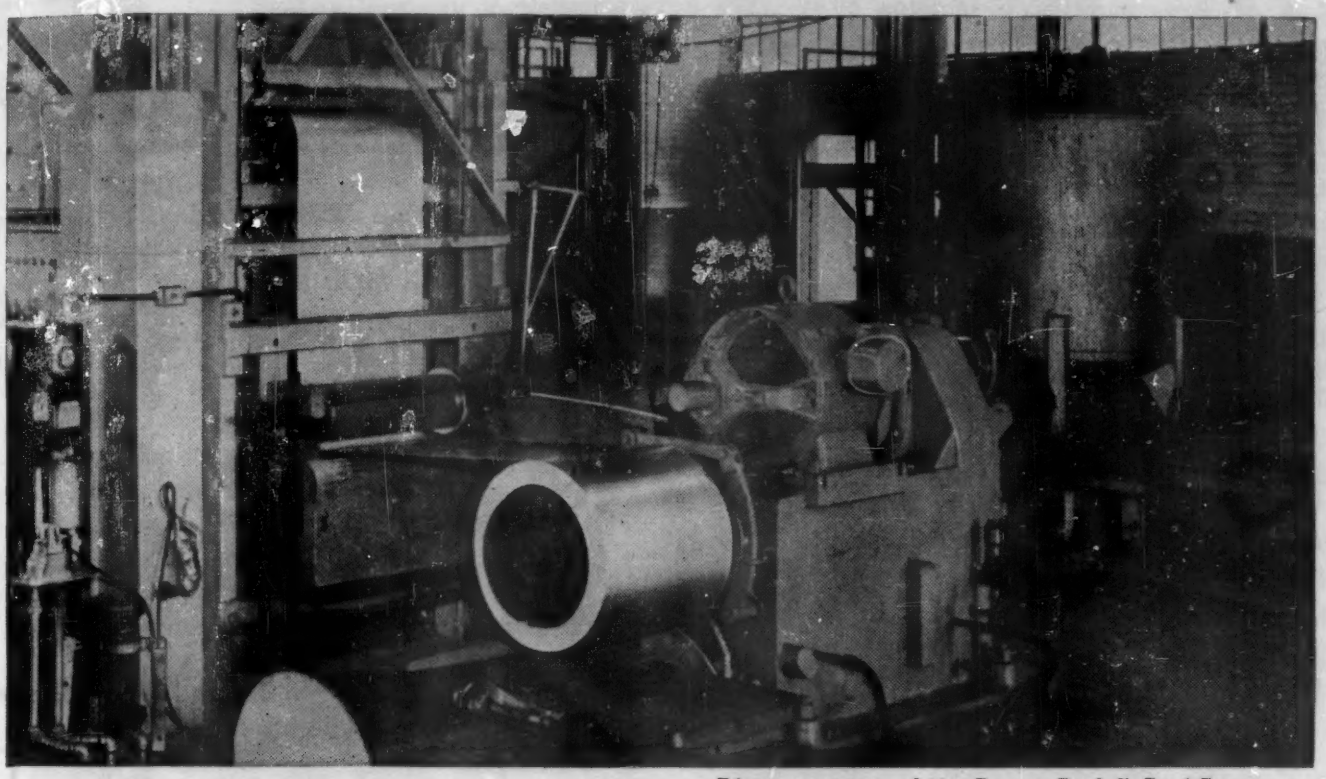
A typical galaxy, like our own "home" mass of stars, is a more or less disk-shaped affair, perhaps 50,000 or 100,000 light-years across, frequently showing a spiral pattern in its organization. We can tell how far away other galaxies are by spotting certain types of stars in them, giants and super-giants, novae and super-novae, and comparing their known actual brightness with the much lower brightness they present because of the dimming effect of distance.

A second chapter on an astronomical subject, the expanding universe, is contributed by Professor Edwin Hubble, of the Mount Wilson Observatory. All the galaxies we know appear to be receding from our part of space at terrific rates, from 150 miles a second for near-by ones to nearly 25,000 miles a second for those near the limit of telescopic range.

That the universe is expanding (perhaps exploding would be a better word) is the only explanation at present possible for the so-called red shift of light given off by these distant masses of stars. The reddening of their light is apparently caused by a "dragging out" of the light waves as their sources speed away. Other explanations have been attempted, but, says Professor Hubble, they have all failed. If there is another valid explanation, it involves a principle in nature of which we are still ignorant.

What fuels the terrific energy production of the stars is the cosmic puzzle taken up by Professor Hans A. Bethe, of Cornell University. Earlier theories, as that stellar heat and light are due to the gravitational compression of their substance as they shrink together, would not keep up the fires long enough. Most satisfactory, it appears, is the concept that atomic nuclei within the stars' interiors capture atomic particles (neutrons) and in so doing are transformed into other elements and at the same time give off energy.

Pressures such as those existing in the interior of the earth, if not of the stars, are described by Professor P. W. Bridgman, of Harvard University. In exceedingly



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Unfortunately, electrolytic tin plate is far from perfect as it comes from the plating baths. It is porous and does not provide a good protective coating.

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massive machines, pressures measurable only in terms of dozens of tons per square inch are applied to various solids and liquids, solidly cased in massive blocks of metal so that they can not "squeeze away." Under such pressures familiar matter assumes unfamiliar forms: a kind of ice with a temperature far above boiling, and so dense that it would sink in water; a variety of phosphorus that is black instead of yellow, and that conducts electricity instead of resisting it.

In other chapters, Dr. V. K. Zworykin, of RCA Research Laboratories, tells of the formation of electron images; Professor Lionel S. Marks, of Harvard University, discusses recent developments in power generation; Professor James Franck gives glimpses of what goes on in a green plant while food is in the making; Professor John G. Kirkwood, of Cornell University, presents a picture of the structure of liquids; Professor Perrin H. Long, of the Johns Hopkins University, outlines the mode of action of sulfanilamide, and Professor H. Mark, of the Polytechnic Institute of Brooklyn, gives the theoretical basis underlying the manufacture of synthetic rubber.

SCIENCE IN 1942

MEDICAL SCIENCES

(Continued from January 8, 1943)

A method of investigating motor nerve end plates and their control of muscle fibers which should give fundamental aid to investigations of paralytic and muscular diseases was developed.

Search for a chemical cure for cancer, involving tests of some 70 compounds, resulted in discovery of one type of chemical which in the test tube apparently interferes with the health of human breast cancer cells and in the same concentration does not interfere with the well-being of any normal organ tissue which has been tested so far.

Indication of prevention of both breast cancer and leukemia in mice by diets lacking only the one chemical, cystine, was reported.

Conclusive proof that normal subcutaneous mouse fibroblasts can be transformed, while growing in culture in vitro, into sarcoma cells, as shown by the production of highly malignant tumors following inoculation of these cultures into mice of the same strain which furnished the normal cultures, establishes for the first time that at least in this instance cancer cells can be produced without the operation of factors (systemic) involving the animal body as a whole.

Chemical structure of biotin, vitamin essential for rat nutrition and believed to hold a clue to solution of the production of liver cancer in rats, was discovered.

Development of a 3,000,000-volt X-ray machine and encouraging results in its use to treat deep-seated human cancers were reported.

Two new cancer diagnostic tests were reported: one distinguishes cancer from overgrowth of the adrenal glands, the other detects early cancer of the uterus by microscopic examination of surface cells shed by the cancer during its rapid growth.

Vitamin C was reported effective in treating and preventing heat cramps and heat prostration and its use for preventing shock after injury or surgical operations was suggested.

Totaquine, from cinchona bark, and two synthetic chemicals, pamaquine naphthoate and quinacrine hydrochloride, were put into the new U. S. Pharmacopoeia XII as acceptable anti-malarial drugs that can be used in place of quinine.

Evidence that vitamins are important for resistance to disease germs appeared in the discovery that mice were more susceptible to fatal infection with Type I pneumonia when their diets were deficient in two B vitamins, thiamin and riboflavin.

A cat infection was linked with the atypical human pneumonia cases of the past few years.

Instruction courses in the Sister Kenny method of infantile paralysis treatment were established by the National Foundation for Infantile Paralysis.

Albumen extracted from human blood was used successfully in treating shock and efforts were reported under way to prepare a safe beef blood albumen for the same purpose.

Successful treatment of headache and dizziness following concussion of the brain, expected to be more frequent as a result of war injuries, was achieved with the synthetic chemical, prostigmine.

Discovery of Kitol, a new parent chemical for vitamin A, expected to double the amount of the vitamin that can be obtained from whale and probably other fish liver oil, was announced.

A new "butter" that resists temperatures up to 110 degrees Fahrenheit and can be shipped without refrigeration was developed by the Army Quartermaster Corps and is being shipped in large quantities to U. S. troops overseas.

Successful vaccination against influenza A of 43 out of 44 boys directly exposed to the virus in a controlled experiment was reported.

Isolation of a toxin from the influenza bacillus (not the virus) and production from it of a vaccine successful in protecting rabbits against this bacillus was announced.

28,585 cases of jaundice, with 62 deaths, occurred in the Army among men vaccinated with certain batches of anti-yellow fever vaccine but following a change in the method of producing the vaccine and restriction of its use to men destined for service in yellow fever endemic areas, cases of the jaundice stopped.

Greater, because safer, usefulness for the sulfa drugs may result from discovery that certain toxic reactions to the drugs, including agranulocytosis, probably result from drug interference with hitherto unknown and as yet unidentified members of the vitamin B group.

Two new sulfa drugs, sulfapyrazine and succinyl sulfathiazole, were announced.

Sulfa drugs appeared as possible preventives of whooping cough; dysentery; bad colds, bronchitis and pneumonia; and as possible cures for Asiatic cholera on the basis of animal experiments and some clinical evidence.

A new kind of surgical dressing for burns and wounds, consisting of a plastic film carrying 30 per cent. to 50 per cent. sulfadiazine, was developed.

Two new germ-fighters isolated from microorganisms were discovered: fumigacin and clavacin.

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SCIENCE NEWS

Science Service, Washington, D. C.

LOESS AND THE FARM LANDS OF THE UNITED STATES

SOME of the best farm lands in America are the product of unimaginably violent dust storms—dry, gray blizzards that howled off the edges of the vast glacial sheets of the Pleistocene Ice Age. They are the wind-deposited soils known technically as loess, that are found over wide stretches of the Midwest and also (though more thinly deposited) in parts of the East.

Wind has long been credited with the creation of the loess, but there have been many things about this soil type that have puzzled geologists. New light is thrown on the problem by Professor William H. Hobbs, of the University of Michigan, as a result of long studies around the ice sheet that covers Greenland—one of the two places on earth where Ice Age conditions still persist.

During Greenland's short but often surprisingly warm summers there is very rapid melting around, and just within, the glacial margins. Heavy floods of water, turbid with suspended mud and sand, pour out, frequently floating off blocks of ice with boulders embedded in them. These eventually become stranded and melt, dropping their boulder loads at considerable distances from the edge of the main ice mass. Geologists know all this solid discharge from under the glacier edge by the vivid name of "outwash."

When the long winter sets in, bitterly cold winds, at velocities of a hundred miles an hour and more, pour down off the interior of the ice sheet. The outwash is soon dried out, and the lighter particles blow outward in great clouds. Sandstorms at lower levels, dust storms at all levels, rule the season. Except for temperature, conditions are not unlike those encountered in the Libyan desert. Exposed stone surfaces are sand-blasted in almost exactly the same manner in both regions.

The outward-blowing dust is halted only by vegetation and does not, therefore, settle permanently upon the outwash plain itself. Around the outwash area it builds up a heavy deposit of the loess, which is thickest about the rim of that area and thins out the other ways. Thus it comes about that in the upper Mississippi Valley the loess has been deposited peripheral to the areas occupied by the last ice sheet, but with an intervening area wherever there has been outwash deposited. This distribution of the loess has long been recognized by glacialists, but has never before been explained owing to the failure to take account of the so-called glacial anticyclone over continental glaciers.

Professor Hobbs has found abundant evidence of the same state of affairs in the abundance of wind-sculptured boulders, in the inland sand dunes of Nebraska, and in the distribution of the Midwestern loess which covers whole Corn-Belt counties and piles up in hills as much as 300 feet high along the banks of the Missouri.

FLUID COAL

"FLUID" coal, a pulverized form of coal which, when mixed with air, can be made to flow through standard pipes a quarter of a mile long, is being studied by fuel engineers at Battelle Memorial Institute, Columbus, as a possible substitute for fuel oil in industrial heating processes.

Preliminary work on the application of this finely ground coal to industrial furnaces—which application if widely adopted may have great effect in alleviating shortages of fuel oil—has demonstrated that the fuel is entirely suitable for use in many types and sizes of forging furnaces, that it has advantages of fluidity similar to those of oil and gas, and that it gives flames of high emissivity which provide maximum heat transfer by radiation.

Of particular importance is the fact that for most sections of the country this material would be more economical for applicable industrial processes than the fuels now being used.

Investigations in the uses of pulverized coal have been in progress at the Columbus industrial research laboratory for several years and are now being intensified under an enlarged research program supported by the bituminous coal industry. Emphasis is being placed upon the application of the finely pulverized coal to forging, heat-treating and other metallurgical furnaces, which now consume great quantities of oil and gas in the war industries.

"Fluid" coal is produced by grinding coal to dustlike fineness in specially designed mills. A stream of air entering the mill picks up the fine particles and delivers them to collectors. The material when not impacted will flow through your fingers and pour somewhat in the manner of a liquid. When mixed with air it demonstrates fluid-like properties, will flow through pipes, and spray out of jets.

That the substitution of pulverized coal for oil and gas in some metallurgical processes is entirely practical is verified by the fact that a number of plants have been using pulverized coal for steel-heating furnaces for many years. In fact, in 1920—in the days before oil and gas became cheap—there were 690 known pulverized coal furnaces in operation in this country. The development retrogressed, however, with the discovery of vast new sources of oil and gas and the sharp reductions in the costs of these fuels.

The investigations indicate that there is great possibility of extending the use of pulverized coal to hitherto unexplored fields. It has been tried in the radiant-tube furnace, which is used in heat-treating, annealing, and enameling, with promising results. The successful application of pulverized coal to this type of furnace would remove the principal disadvantage of coal in refined metallurgical work, namely, the fly ash, cinder and sulphur, since combustion takes place inside alloy-steel tubes lining the walls of the furnace.

Finely pulverized coal ignited in air burns rapidly, releasing great quantities of energy. A part of the Battelle investigation of this fuel, but one having less immediate application in industry, is the study of a direct means to harness this energy.

THE CHEMISTRY OF THE HIGH POLYMERS

DR. H. MARK, professor of organic chemistry at the Polytechnic Institute of Brooklyn, speaking before the North Carolina State College chapter of the Society of Sigma Xi, stated that the difference between a springy rubber-like substance and a hard plastic or a tough fiber, either synthetic or natural, lies in the tendency for the molecules of these substances either to contract or to form crystals.

The more crystallization in its structure the more the substance becomes a typical fiber, such as nylon, silk, cotton or rayon. If the mutual attraction between the chain-like molecules of a given material is low, then it will show mainly the properties of an elastomer such as rubber, Buna S, Neoprene, Hycar, butyl rubber, etc. This is also true if the molecules do not fit well into a regular three-dimensional lattice structure. In between these extremes, the substance will show the properties of a plastic, such as hard rubber, methacrylate (lucite), vinylite, polystyrene or ethyl cellulose. Present experimental knowledge shows that all these substances have about the same fundamental structure, but it is their ability to crystallize that gives them different properties.

All types of what the chemist calls "high polymers," whether they be rubbers, plastice or fibers, have the same high order of polymerization, that is, their molecules are composed of about 2,000 or more atoms. "Polymerization" is the name that the chemist gives to the process of making big molecules out of little ones. Either by natural processes or by the skill of the chemist's reactions, simpler materials are built up into more complex ones to form our most useful rubbers, plastics and fibers. These are molecules in which the atoms are visualized as being in a long chain.

"During the past fifteen years," Dr. Mark said, "a new branch of organic chemistry has been started and gradually developed. This is the chemistry of the high polymers. The natural products belonging to this class of substances, for example, cellulose, starch, proteins, chitin, rubber, etc., have been known for a long time, but it was only recently that successful attempts were made to elucidate their molecular structure and to realize their common fundamental building principle. Synthetic products of resinous character built up from small molecules, such as formaldehyde, ethylene oxide, vinychloride and styrene, have also been known for some time, but again their molecular structure and their fundamental relationship with the natural high polymers were not known until about ten or fifteen years ago."

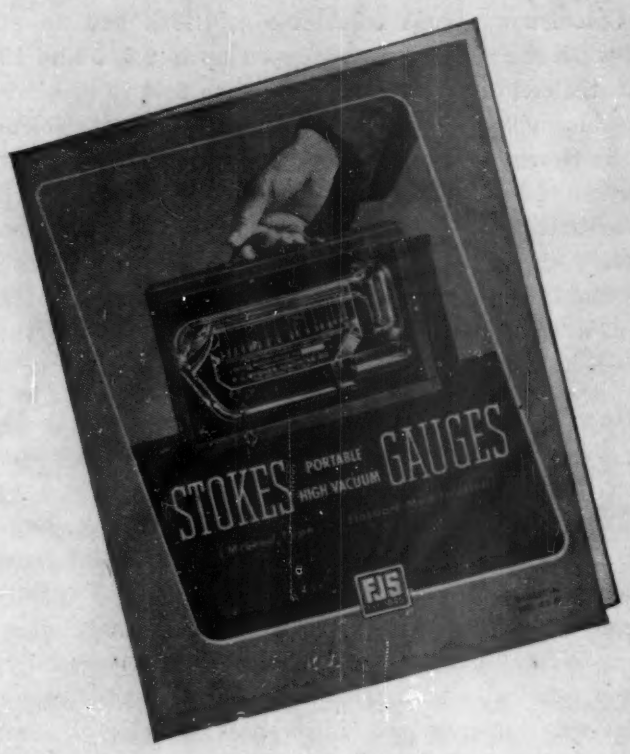
ITEMS

COLCHICUM, the plant that produces colchicine, is not immune to the effects of its own drug, is indicated by experiments by Dr. Ivor Cornman, of the University of Michigan. Since colchicine produces the sudden evolutionary changes in plants that have made it famous in recent years by a partial checking of cell division, giving new cells two or more times the normal number of heredity-bearing chromosomes, Dr. Cornman made his tests simply on cell division in root tips of two species of Colchicum. Weak colchicine solutions had no effect, but when the strength was stepped up to 2.5, 5 and 10 per cent. the cell-division process was seen first to be hindered, then blocked altogether. Since there is always colchicine in the tissues of Colchicum, the question naturally arises, how can cell division go on at all? Why doesn't the plant make itself extinct with its own poison? Dr. Cornman doesn't undertake to answer. He merely remarks that the immunity must be found somewhere else than in the plant's mechanism of cell division. Details of the research are reported in the *Botanical Gazette*.

How cattle and sheep are aided by bacteria in digesting the crude fiber of the grass and fodder they eat has been demonstrated by a new technique devised by F. Baker, of the Guilford County Technical College, England. Mr. Baker's method is described in a statement from the Science Committee of the British Council. Partially digested materials are removed from the animals' digestive tracts either in the slaughter house or from specially prepared surgical openings in living specimens. Under the polarizing microscope, differences in light direction through the materials indicate digested and undigested parts. The role of the bacteria is indicated when iodine is added. Where the bacteria are active, purple spots show the presence of starch-like substances, formed within the bacterial cells out of the cellulosic materials in the crude fiber. Apparently it is this bacterial starch that actually furnishes the nutrition to the animals.

COLOR changes in the test tube will enable chemists to measure amounts of the silver-white metal, palladium, in solutions as dilute as 1 in 300,000,000 parts. The method was developed by Dr. John H. Yoe and co-workers at the University of Virginia. This is the first procedure to be discovered which will detect such minute traces of the metal. It will be useful in analyzing and studying the platinum group of metals and their alloys. Palladium is used in dentistry, jewelry and to speed certain chemical reactions. A new color method for detecting traces of iron as small as one part in 75,000,000 was also discovered. Analysis by weighing, rather than a color change, is the final step in a procedure to test tungsten ores and steels, an important metal in war production. These investigations were part of a research program being conducted by Dr. Yce and his associates to discover new and more sensitive organic analytical solutions for detecting and determining amounts of chemical elements and their compounds. Such studies have important applications not only in chemistry, but also in medicine and biology.

EXPERIMENTS performed by Professor E. H. Hughes and R. L. Squibb, of the University of California College of Agriculture, indicate that pigs as well as people need vitamins. The newest need on the porcine diet list is pyridoxine, member of the vitamin B complex also known as B_6. Lack of this compound caused a number of distressing (and costly) symptoms, including loss of appetite, poor growth, fits and anemia. Normal health was restored by daily doses of a mere pinhead quantity of pyridoxine—five milligrams per hundred pounds of pig.



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ANNUAL REPORT OF THE SECRETARY OF AGRICULTURE

LESS wheat, more meat; also more vegetables, eggs, dairy products, vegetable oils; steady on cotton and tobacco. This in a nutshell is the array of goals for American farmers in 1943, as summarized in the annual report of Claude R. Wickard, Secretary of Agriculture.

It is quite different from the agricultural aims of the last war period, when all the accent was on wheat. Ever since 1918, wheat has been produced in excess in this country, and with the war-caused total eclipse of export markets it has been piling up. The national carry-over as of July, 1942, was 633,000,000 bushels, to which the year's huge crop of about 984,000,000 bushels was added. The total is enough to meet all our bread needs for two years, even if no wheat at all should be harvested in the meantime.

In response to urgings of the department and the stimulus of reasonably good meat prices, farmers and stock raisers have built up their herds to new highs. The cattle population reached nearly 75,000,000 head a year ago, and despite heavy slaughter is being maintained. Pigs topped the hundred-million mark with five million extra to spare —enough for nearly five sixths of a whole hog apiece for every person in the country, except that we're sending part of our pork chops and bacon overseas to our armed forces and our fighting allies.

Use of some of our surplus wheat for feeding livestock and chickens is recommended by Secretary Wickard, so that we may increase supplies of meat, milk and eggs, all of which need to be maintained at the highest attainable levels.

An additional outlet for wheat is the international pool set up by the four great wheat-raising countries, the United States, Canada, Australia and Argentina, for the eventual relief of war-ruined countries. This pool now consists of 100,000,000 bushels, and is to be increased as need arises.

With a cotton surplus of more than 11,000,000 bales on hand, and the mills unable to spin it up much faster than they are doing now, increases in cotton production are not being encouraged. Instead, cotton farmers are asked to shift over to peanuts (for oil) in so far as possible, and also to substitute long-staple for short-staple varieties. Lower yields of the important co-product, cottonseed oil, are to be offset by increased production of other vegetable oils, notably soybean, flaxseed and peanut.

Tobacco stocks on hand are so large that no increase in acreage in this crop has been held justified, except in two types, flue-cured and Maryland, on which lend-lease requirements call for increases of about 10 per cent. over the 1942 figures.

The greatest possible emphasis is being placed on vegetable production, both by large-scale professional growers and home gardeners. Military and lend-lease shipments call for immense quantities of dehydrated vegetables, and an intensive drive for the 1943 Victory gardens will soon be under way.

SEEDLESS TOMATOES

TOMATOES can be induced to produce seedless, more solidly meaty fruits by treating the plants with the fumes of a growth-promoting acid, naphthoxyacetic acid, at or before the time the flowers open. Experiments along these lines, which may have important horticultural applications, were performed in the greenhouses of the great experimental farm of the U. S. Department of Agriculture at Beltsville, Md., by Dr. John W. Mitchell and Muriel R. Whitehead, of the Bureau of Plant Industry. Results will be reported in the forthcoming issue of *The Botanical Gazette.*

Use of growth-promoting chemicals to induce formation of seedless tomatoes and other fruits had already been reported by other investigators. However, their methods involved the use of sprays, or even the direct application of the substances to the flower-parts with brushes or by other hand means. Getting similar results merely by subjecting plants temporarily to self-distributing fumes from a few milligrams of the acid obviously saves a great deal of time and labor in the treatment.

In their experiments, Dr. Mitchell and Miss Whitehead placed a number of tomato plants in a closed chamber, so that the exact concentration of the fumes could be measured. They used 250 milligrams (1/120 troy ounce) of beta-naphthoxyacetic acid per thousand cubic feet of room space, evaporating it on a hot glass plate over an electric heater. After exposure to the fumes overnight, the plants were taken back to the greenhouse, where an equal number of untreated plants were placed with them for comparison purposes.

As the flowers opened, both treated and untreated plants were all carefully hand-pollinated. When the tomatoes were mature, they were compared for flavor, vitamins and total mineral content. Except for the fact that the tomatoes from the treated plants were nearly or quite seedless, no differences could be detected between the two lots.

THE STUDY OF WAR METALS

BY bouncing a beam of light off a tiny metal mirror, metals can now be observed changing into alloys and the rate at which metals diffuse through one another can be ascertained in a few minutes.

Developed by Dr. Howard S. Coleman and Professor Henry L. Yeagley, physicists at the Pennsylvania State College, the new method replaces tedious processes which took months and years. It helps to speed the study of war metals, just as other phases of the war program have been accelerated. New information will be obtained about improving alloys, the metal mixtures so important in the war. Studies may reveal more about the resistance of metals to heat and suggest ways of improving this quality. This same process might be used to prevent metal

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corrosion. Fundamental things that occur in aging metals are being discovered.

Thin metal films only about a fourth the thickness of ordinary typewriter paper are being used. First, the metals are vaporized, then deposited on the top of one another as films on a glass slide, thus forming a mirror. They are then removed from the vaporization chamber, heated to the desired temperature and the diffusion rate observed.

The diffusion of these thin films usually occurs in a few minutes, compared to the many months often required by old methods which used larger quantities of metal. This also involved prolonged heating at a temperature of several hundred degrees while only slight heat is required by the new method. Sometimes even the heat of the hand is enough to start diffusion of thin films. To follow the speed of diffusion, the amount of light reflected from the mirror film is measured. A normal metal surface has a certain reflecting power. But as one metal spreads through another the amount of reflected light is changed. This change is measured by a recording instrument called a galvanometer.

TESTS OF PLANE ENGINES

MORE than half the power needed to operate an engine factory can be recovered from tests of plane engines, was reported by G. E. Cassidy, W. A. Mosteller and W. L. Wright, of the General Electric Company, at the New York meeting of the American Institute of Electrical Engineers.

The power-recovery method has helped the war effort by giving to the aircraft engine industry a testing technique that contains advantages not available in other methods. Testing can be done with greater ease and in less time on a basis that is economically sound.

Previous to the development of the new power-recovery system, energy produced during testing was dissipated by water brakes, propellers, electric brakes and other devices which involved complete wastage. Fuel consumed accomplished no useful purpose other than testing of the engine. Furthermore, engines became so huge that schemes to dispose of the power by wastage began to present difficult problems.

Starting with an inquiry for an improved method from Pratt and Whitney Aircraft, development of the power-recovery system has gone through several phases. Using an induction generator, one of the latest set-ups begins the test with a cold start and run-intest for checking mechanical operation and lubrication of the engine. Then speed is gradually increased. When ready to "fire" the ignition switch is turned on and the engine throttle adjusted to idling speed. As the throttle is opened, the generator speed passes through synchronism and load is automatically applied to the engine. Any desired values of load and speed can be established. From such a test, the engineers reported that 3,000 to 6,000 kilowatt-hours of energy may be recovered from each engine of current-large rating. It was pointed out that "the advantages of the power-recovery system applied to the testing of aircraft engines have not yet had time to be universally appreciated. It may be quite possible that with the passing of time the engine builder will point with more and more favor (toward wider use of the method) because he is already pointing toward larger aircraft engines—and the larger the engine the more advantageous power-recovery testing becomes."

SOURCES OF RUBBER

NOREPOL, the rubber-like material synthesized from soybean, corn and other vegetable oils by chemists of the U. S. Department of Agriculture at the Northern Regional Laboratory in Peoria, Ill., is now going into commercial production. Two companies are making it under trade names of their own, while others are producing it under the coined name given it by the department.

Norepol is a combination-word formed from the first syllables of NOrthern REgional POLymer. Technically it is a polymer of linoleic acid, one of the fatty-acid fractions of many vegetable oils. A polymer is a compound with big molecules, formed by welding together smaller molecules of other compounds. As a rule, polymers are "thicker," more solid, and harder or more elastic than the substances from which they are made.

Norepol, although rubber-like in its properties, is not a full substitute for rubber. It will stretch to only twice its normal length, instead of six times as in real rubber. Its tensile strength is only 500 pounds per square inch, as compared with 3,000 pounds or more. Nevertheless, it has good resistance to abrasion and aging and is impervious to water and alcohol, so that it can replace rubber in such uses as shoe heels, fruit jar rings, gaskets and tubing. Demand for norepol is estimated at 12,000 pounds or more for the current year. Since only the fatty acid from the oils is used in its manufacture, the other half of the oil compound, glycerin, is released as a co-product for the manufacture of explosives and other technical purposes.

Natural rubber from two other sources fostered by the Department of Agriculture is beginning to come in. More than 18,000 pounds of kok-saghyz roots have been harvested from the first experimental plantings, made possible by large shipments of seeds of this rubber dandelion rushed to this country from the beleaguered Soviet Union last spring, even while the Nazi armies were storming to new conquests. This harvest represents only a small fraction of the plants grown in many plantings over a large part of the country, to test the adaptability of the plants to American soils and climatic conditions. The greater part of the first year's crop has been left in the ground, to test the plants' over-wintering abilities in this country. In the meantime, labor-saving machinery has been worked out to harvest the first American-grown crop of seed.

It is emphasized that all the work thus far is experimental. No appreciable amount of dandelion rubber will be harvested in the immediate future, nor will any seed be available to farmers who may be thinking of growing the plant themselves.

The native American rubber shrub, guayule, is making a small beginning, on lands taken over from the Intercontinental Rubber Company by the U. S. Department of Agriculture. A mill operated by the U. S. Forest Service

at Salinas, Calif., will turn out 600 tons of guayule rubber this winter, using older shrubs that were already growing before Pearl Harbor. Plantations being established this winter are expected to yield about 21,000 tons from the harvest starting late in 1944. Further extensions will put the figure up to a maximum of about 80,000 tons. Although this is not much more than a tenth of the annual rubber requirement in this country, it will be distinctly helpful.

CAUSES OF LOST TIME AMONG SHIPYARD WORKERS

FLASH burns of the eyes and cinders or other foreign bodies getting in the eyes are among the most serious and frequent causes of lost time among workers in shipyards, was reported by Dr. Philip Drinker, of the Harvard School of Public Health, to the Congress on Industrial Health meeting at Chicago sponsored by the American Medical Association. The report was based on findings of a survey he and Dr. John M. Roche, serving as consultants on safety and health for the U. S. Navy and U. S. Maritime Commission, made of selected shipyards with government contracts in all parts of the country.

These eye injuries are obviously preventable, Dr. Drinker said, but he pointed out that ships are now being built in yards which cover very large areas with welding going on everywhere in them. It is very difficult to prevent flash burns of the welder's neighbors. The danger extends even to the experienced welder who lifts his shield momentarily and happens to be near another man welding.

A serious risk of lead poisoning also exists in the shipyards because of modern high-speed construction schedules. It is common shipbuilding practice to paint all metal surfaces as soon as possible with red lead. Generally this is done after the metal plates are in final position, but to keep fast construction schedules, some pieces are painted in the yards. Welding these painted surfaces brings the danger of lead poisoning, against which special care must be taken for workers' protection.

Special ventilation to control welding fumes is necessary for the men working on the fore and after plates and double bottoms where, because of prefabrication type of construction, the men must work in relatively small spaces.

Paint sprayers, their assistants and those working in the immediate vicinity require special protection. To make sure that the men are provided with efficient protective equipment, only such masks and respirators as have been approved by the U. S. Bureau of Mines may be used in shipyards with government contracts.

In general, Dr. Drinker found the medical and safety departments of the yards well organized and well run, although the high proportion of "green" workers complicates the safety problems. Many yards have as few as one or two per cent. of experienced men who had worked in shipyards before the war.

"We have been badly hit by the shortage of doctors in some districts, especially in rural communities," Dr. Drinker said, "but probably we are no worse off than many other industries. We doubt if our position in this respect represents any new problems."—JANE STAFFORD.

ITEMS

FOUR bushels of Cayuga soybeans, a variety developed by plant breeders at Cornell University, have been shipped to the Soviet Union through the Russian War Relief for trial plantings as a feed and food crop. Cool weather and short growing seasons in Russia resemble conditions of New York state. The Cayuga variety matures in any part of New York up to 1,600 or 1,800 feet elevation. Soybeans of the Corn Belt will not mature in New York or in the cool areas of Russia. The Cayuga's yield is from 20 to 25 bushels or more of dry beans to the acre.

BLACK cotton is a new variety recently originated by Russian plant geneticists, according to a bulletin of the Soviet embassy. One advantage which this cotton has, together with other varieties with colored lints ranging from reddish to green, is the eliminating of the dyeing process. It is believed that the natural black will be a faster color than the black of dyed cottons. American cottons with green and brown tints have been known for some time, but are not grown on a large scale because their yield is considerably lower than the white-linted varieties. Our colored cottons are used principally in certain regional handcrafts industries.

HOPES of greatly increasing vegetable and field crop yields through chemical treatment of seeds are somewhat damped by a report in *The Botanical Gazette*, on negative results of a large number of experiments by Dr. William S. Stewart and Charles L. Hamner, of the U. S. Department of Agriculture. A number of growth-regulating substances, including several commercial preparations intended for seed treatment, were tried on the seeds of a considerable assortment of plants, ranging from field crops like corn, wheat and soybeans to garden vegetables such as radishes, carrots and squashes. They were grown under a wide variety of soil and climatic conditions in three places—the Experiment Station at Beltsville, Md.; the University of Chicago, and Lake Geneva, Wis. In all cases, significant increase in yield as a result of the chemical treatment of seed could not be detected.

SOYBEANS are used to produce laminated board, valuable in aircraft and other war industries, in a new method announced by Dr. George H. Brother, of the Regional Soybean Industrial Products Laboratory of the U. S. Department of Agriculture. Sheets of unsized kraft paper or other fibrous material are soaked with a formaldehyde solution of soybean protein. After drying, stacks of these plastic sheets are united into laminated board by heat and pressure. This method promises to augment the nation's limited supply of high-priority phenolic resin now being used. Low water-resistance of the resultant board created a problem. Single sheets of the more waterproof phenolic resin placed on the top and bottom of the stack of soybean sheets before pressing, was the solution. Production of laminated board has been speeded by the new process, according to Dr. Brother, since pressing time for phenolic resin board is about five times as great as when soybean-protein-phenolic material is used.

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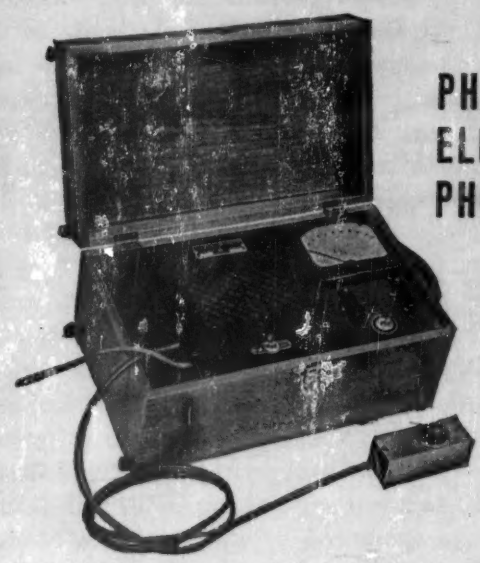

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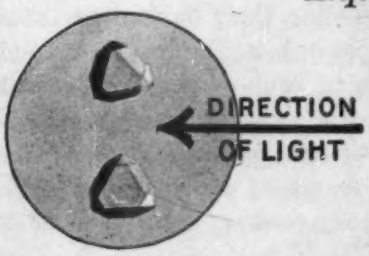

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SCIENCE NEWS

Science Service, Washington, D. C.

INFLUENCE OF SUNSPOTS ON WEATHER

VAGUE correlations between sunspots and the weather probably exist, but the weather is affected so much by other factors that the influence of sunspots is insignificant. This is reported in a lecture at Stanford University by Dr. Seth B. Nicholson, of the Mt. Wilson Observatory, after a quarter of a century devoted primarily to solar research concerning the much-discussed question of whether the weather can be predicted from sunspot activity.

Dr. Nicholson conceded, however, that conditions upon the sun are not exactly the same when there are many spots as when there are few, and that any change in the sun's radiation will certainly be reflected some way in the weather. Ever since the great astronomer, Sir William Herschel, in 1800 tried to correlate the price of wheat with the number of sunspots, not only astronomers, but meteorologists, botanists and bankers, both professional and amateur, have been trying to find such correlations without much success. Invariably they arrive at the same conclusion as Herschel—more data are needed in order to prove them. This is true in spite of the fact that both the quantity and quality of solar data have greatly increased since Herschel's time.

With regard to the possibility of making short range predictions for particular regions from individual sunspots, Dr. Nicholson was even more emphatic. He said: "Certainly it is foolish to think that an individual sunspot can in any way produce definite changes in the weather at any particular locality on the earth."

SNOW

DON'T grumble if there's a lot of snow in your neighborhood. Be thankful instead. Snow is one of the important ingredients of victory. Not, perhaps, in the direct sense that it is in Russia, but our American snow is a great help toward the goal none the less.

Snow on the ground now means bread and milk on the table before next winter's snow begins to fall. For winter wheat and other fall-sown grains depend on snow now for protection against the cold and drying winds of winter, and they will depend on the water from the thaw for most of their growth in spring. If they get a good start in late March and during April, a very little rain in May will suffice to make the crop that will be harvested in July. Similarly, snow makes the early hay crop and the spring pastures, on which our milk supply depends to a large extent.

Snow is a major source of the water that few of us ever even think about, except weather men and agricultural scientists; what is known as subsoil water. This is the moisture well below plow level, on which trees and bushes depend, and the deeper-reaching roots of maturing crops. Corn roots, for example, go down from three to five feet; alfalfa roots as much as twenty. And it is this moisture reserve that they depend on.

Water that trickles down through partly melted snow during occasional winter warm spells is an especially good means for replenishing this deeper deposit on which crops may draw later on. Such melt-water can not run off very well; there is nowhere for it to go but down. It is only when the snow cover melts away completely that there is cause for anxiety—the more so since the winter grains are then left naked to possible fierce sudden freezes or hard dry winds. No Northern farmer feels easy in winter if he is able to see the soil in his fields.

How much water it takes to make a bumper crop is vividly brought out in a calculation recently offered by J. B. Kincer, of the U. S. Weather Bureau. Comparing the excess of water that fell in the abundant crop year of 1942 with the scanty fall during the desperate drought of 1934, he said: "If it were possible to load this excess water on super-trains of 100 tank cars, each carrying 100 tons of water, and transport them over a super-railroad at the rate of two trains a minute around the clock without missing a single schedule, it would require more than 100 years to complete the shipment."—FRANK THONE.

HEARING AND VISION OF AMERICAN FLIERS

CHANGES in plane designs to aid the hearing and vision of American combat fliers were recommended to the Institute of Aeronautical Sciences meeting in New York. Professor Walter R. Miles, of Yale University, stated that "Both seeing and hearing, if accompanied by prolonged attentive effort, especially under conditions of unfavorable plane design, are capable of contributing to pilot and air crew fatigue and loss of efficiency." Collaborators with Professor Miles in preparing the report were Commander Leon D. Carson, head of the Medical Research Section in the Navy's Bureau of Aeronautics, and Professor Stanley S. Stevens, one of the directors of the Psycho-Acoustic Laboratory at Harvard University.

Plane gunners should be moved much nearer the aiming window. The position of the gunner now gives him the same sort of vision as he would have in a tunnel, since his eyes are some distance away from the window. Sections of gun mounting, electrical switches and other gadgets which lattice the aiming window are also a hazard to vision and life. The amount of structure in front of gunners should be reduced. Clearing away these obstructions to vision and moving the gunner nearer the window will "increase his angle of uninterrupted view, make visual pursuit of his targets easier, and reduce the blinding effect from the flashes of his own guns."

In the cockpit, the instrument panels have too large an illuminated area. They are usually illuminated too intensely and with a color that disturbs night vision. Indirect red light was recommended by Professor Miles and his associates as best. Discussion of vision from the cockpit disclosed that transparent enclosures often become discolored with exposure to sunlight or become checked due to temperature changes and vibration.

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Dr. Miles pointed out that "Rapid strides in development of better plastics are being made, and it should be possible soon to mold transparent cockpit enclosures of better grades of optical plastics in one piece. Surface hardening of such molded parts is desirable."

The ears of flying personnel take even greater abuse than their eyes. Noise from air turbulence around the plane is in some ways more disturbing than the noise from the propeller itself. The interior of a glider plane, for example, is a very noisy place when traveling at 150 miles per hour. Conversation is difficult if not impossible. Several methods were suggested for overcoming the distracting noises of combat flying. "Judicious use of sound treatment in the plane, conversion to high-fidelity microphones and earphones, and the development of acoustic devices to shield the mouth and the ears of the personnel," Professor Miles said, "will permit the aviator to carry on in the best noises which the aeronautical engineers are now planning to produce."

THE PHYSIOLOGICAL STRAINS OF MODERN FLYING

ENGINEER and biologist must cooperate if human beings are to be really successful in handling the formidable flying machines which aeronautical invention has given them, was emphasized by Professor D. W. Bronk, of the University of Pennsylvania, at a lecture sponsored by the national science honor society, Sigma Xi. The biologist, and in particular the biophysicist, has as his task the discovery of the performance limits of the units of the human nervous system. The engineer must adapt his machine to a controlling organism operating within those limits.

As an example of these performance limits, Dr. Bronk cited the now familiar "blackout" experienced by dive bombers in pulling out of a steep, fast dive. It is known that the centrifugal effect of this sudden upswerve drains the blood away from the brain, and "blackout" results.

Basic reason for this momentary unconsciousness is oxygen starvation on the part of the brain cells. Brain cells are at all times very greedy for oxygen; they never have more than a few seconds' supply on hand. So anything that cuts off fresh supplies, even for a little while, creates a physiological crisis—threatens a shutdown for lack of an essential material.

Professor Bronk described some of the exceedingly delicate instruments used in modern physiological research to obtain data on the needs and capacities of nerve and brain cells. The chronic state of incipient oxygen starvation of the brain cells was discovered by means of a microscopic metallic electrode than can be inserted into various regions of the nervous system with relatively little damage. Differences in the minute electrical current transmitted tell tales of fluctuations in amount of oxygen present, and hence of the relative state of efficiency of the cell at the moment.

Nerve cells can be isolated, yet kept alive, and thus studied as single units. Thus isolated, their structure can be analyzed by new electrical, optical and electron-microscopic methods. The electron microscope gives new vistas into the molecular architecture of the cell. The electrical states tell of its internal responses to fluctuations in the supply of essential elements such as calcium and phosphorus, and other environmental influences.

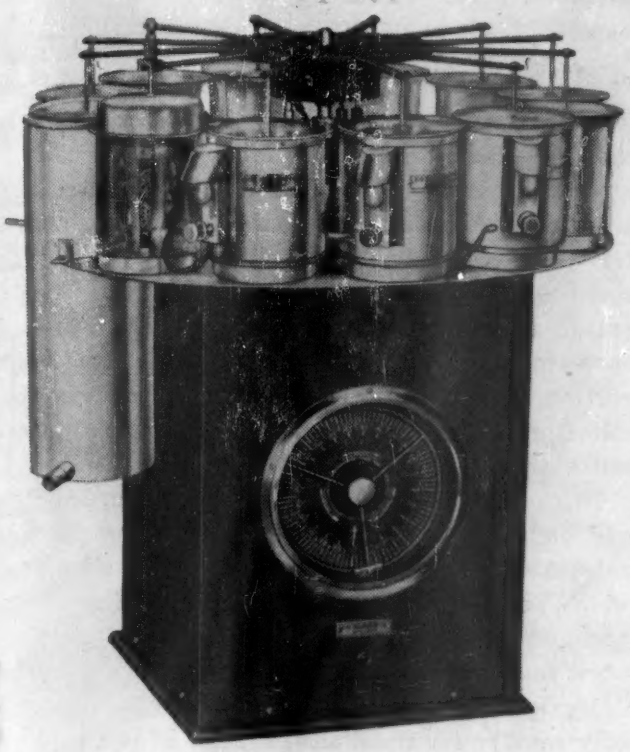
ITEMS

DIESEL engine power may soon be increased by superchargers similar to those now used on plane engines. Problems involved in thus increasing our power supply was discussed at the Detroit meeting of the Society of Automotive Engineers. A Swedish supercharger now being applied to American engines was explained in a paper prepared by Alf Lysolm, of Aktiebologet Ljungstrom, Augturbin, Sweden, and Ronald B. Smith and W. A. Wilson, of the Elliott Company, Jeanette, Pa. Such a device now being manufactured weighs only 80 pounds and handles 400 to 500 cubic feet of air per minute. Other sizes adequate to serve the largest diesel engines can be built, the report stated.

To protect passengers in stratosphere planes, the cabin must be sealed airtight. Progress and difficulties encountered in solving this complicated problem were reported at the annual meeting of the Society of Automotive Engineers by R. L. Ellinger, of Transcontinental and Western Air, Inc., Kansas City, Mo. The cabin must be filled with air at proper temperature and pressure, the speaker pointed out, regardless of outside conditions and the major problem of stopping leaks. Seals of many types and designs are needed at points where controls pass out of the cabin. Actual planes must be used as flying test laboratories, as simulated conditions in test chambers were not successful.

CENTRAL and South Americans will soon be practicing splinting, bandaging and artificial respiration on each other, as we did last winter and spring, it appears from an announcement made by Chairman Norman H. Davis, of the American Red Cross in Washington. The gray paper-covered American Red Cross first aid text-book, now familiar to millions of North Americans, has been translated into Spanish and Portuguese and will soon be available for distribution to all Central and South American countries. The translations will be made by the Mexican Red Cross and the Brazilian Red Cross with the permission of the American Red Cross. Previously, its distribution had been limited to Mexico and Venezuela.

IF you are taking fresh yeast as a means of getting extra vitamins into your system, boil it before you eat it. The human body apparently can extract two or three times as much thiamin or vitamin B_1 from boiled yeast as from fresh, according to a report by Dr. Helen Parsons, of the University of Wisconsin, at the Detroit meeting of the American Dietetic Association. Boiling the yeast, though troublesome and likely to make it less palatable, increases the amount of two other B vitamins (riboflavin and vitamin G) the body can get from the yeast. Pronouncements on boiled vs. fresh yeast were based on experiments with ten students and with laboratory animals.



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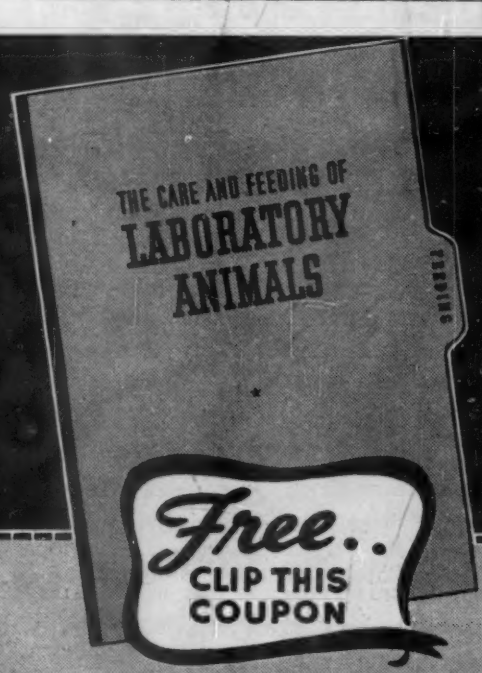

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SCIENCE NEWS

Science Service, Washington, D. C.

THE CITRUS FAMILY

THE citrus family has had its pedigree revised and brought up to date by a veteran Department of Agriculture botanist, Dr. Walter T. Swingle. Results of his studies, which are expected to be of considerable use to breeders developing new hybrids and to orchardists seeking hardier stocks for grafting, will be published soon in monograph form by the University of California Press, as part of a series of major scientific publications in celebration of the seventy-fifth anniversary of the founding of the university. Dr. Swingle's monograph constitutes the first complete reexamination of the citrus family tree since 1824.

Under the new arrangement, the family consists of 33 genera, only one of which, the genus Citrus itself, is extensively cultivated for its wide variety of edible fruits. However, any one of the 32 other Cinderella sisters in the group might, if managed correctly, assist in producing valuable new hybrids, or offer hardy roots on which present varieties of citrus fruits may be grafted. Furthermore, though these others do not at present produce edible fruits, some of them have good possibilities as ornamentals.

In working out the relationships of the many species in the family, Dr. Swingle made use of a radical new method of study. Ordinarily, a botanist studying pressed herbarium specimens examines the dried flowers whole, usually after picking one off and soaking it in water. This inevitably destroys a piece of the specimen; and often when there is only one specimen to be had, the herbarium curators are reluctant to let it go for this purpose.

Dr. Swingle, using a procedure pioneered in World War I days by a noted Swedish botanist at Upsala, embedded single flowers or buds in paraffin and sliced them into transparently thin specimens for examination under the microscope. One specimen was thus multiplied into scores. The method also made possible far more accurate and critical examination of anatomical details than was possible under the older procedure.

Since 1935, when he began his work on the reclassification of the citrus family, Dr. Swingle has accumulated more than a quarter-million such microscope-slide specimens, each keyed to connect it up with the original pressed plant on a herbarium sheet somewhere in one of the world's great museums or universities. The whole quarter million can, if necessary, be packed in a box of only three cubic feet capacity.

The citrus family has a curious geographic distribution. Its principal area stretches from Indomalaysia southeastward as far as Fiji. There are also a number of genera in Africa; none elsewhere in the Old World, and none at all in the Western Hemisphere.

TUNISIA

As Tunisian rainy season for early 1943 draws to a close, combat activities become possible in the semi-desert areas south and west of the seaport city, Sfax. January is usually the wettest month in this westernmost of French possessions in North Africa. Its rainy season is roughly from October to April. The other months are hot and dry—usually with little or no rainfall.

Southern Tunisia has little rain at any season. It is a desert area. Northern Tunisia is mountainous except for a flat coastal rim. The United Nations' fighting forces are in the mountainous country, the Axis on the coastal rim. American forces are reported to be in the northern part of middle Tunisia, the area stretching northward from the semi-desert country along the great salt-depression called Chott el Djerid, the largest of the salt-water lakes or chotts of Tunisia.

In the mountainous area are farms, grazing ranches, and timbered areas with growths of marketable evergreen oaks, Aleppo pines and cork trees. The olive groves for which Tunisia is famed are on the coastal rim from Sfax, which is to the northeast of the Chott el Djerid, northward to Tunis.

Mountainous middle and northern Tunisia is not an easy country for troop movements. It is a land of mountains and plains but without plateaus. It is rough and badly eroded in some sections. It is not supplied with good roads. Getting about in the rainy season is a mud-fighting job. But with new military roads constructed by the Army and with additional flying fields, the path is cleared to drive the enemy on the coastal plains into the Mediterranean.

It is a difficult country in which to obtain food and fighting equipment for an army. Considerable quantities of wheat and barley are produced, some of which are exported normally but not enough to be of much help in feeding the United Nations' troops. It produces many goats, considerable numbers of sheep, and some cattle. Goat meat is not included in the American army diet, and enough local mutton and beef can not be purchased to meet the needs.

Supplies of all kinds must be transported over a long and difficult road. They are brought by ships to Casablanca, and from there by standard-gauge railroad to western Tunisia. Then they must be reloaded onto narrow-gauge cars or army trucks for transportation to middle Tunisia. They are carried by railroad and highway a distance equal to half the distance from Washington, D. C., to Los Angeles. Some supplies and equipment are unloaded from shipboard at Algiers. Transportation from there is over the same standard-gauge and narrow-gauge railroads.

Shortage of railroads and highways in Tunisia is due to the easy water transportation of the country. It has the Mediterranean on the north and on all of the productive east. It has many good harbors for medium-sized ships and one at Bizerte for the largest ships. But these ports are not yet available for the United Nations.

The small population of Tunisia and the rather simple life of the inland inhabitants have not required the transportation facilities necessary in certain other countries

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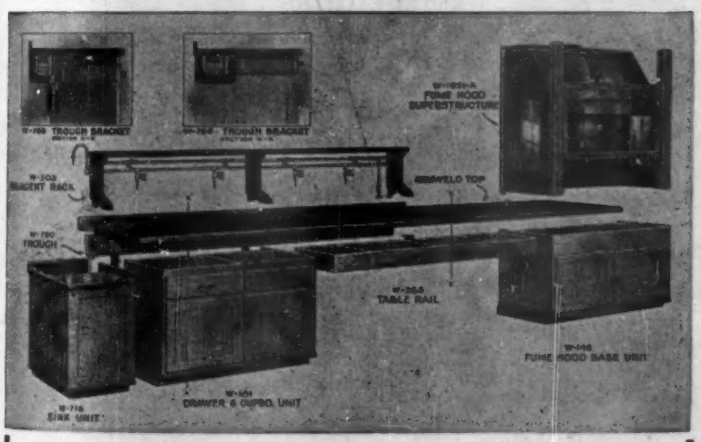

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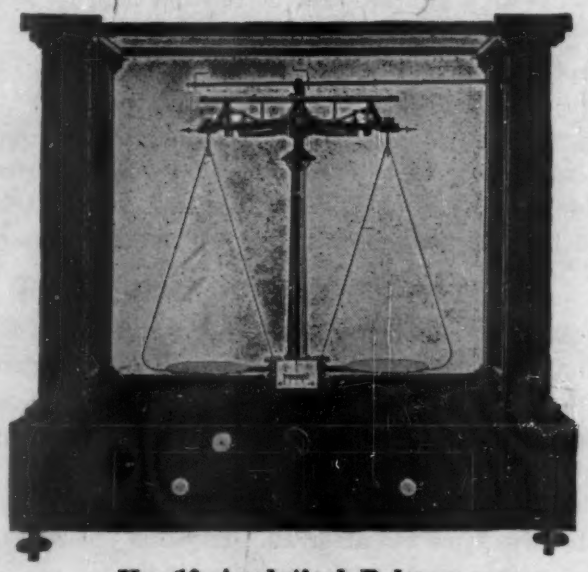

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where the people are more interdependent upon each other. Approximately three million inhabitants include about 2,400,000 natives, Berbers in the northern part and Arabs in the south. The 110,000 persons of French blood are largely in the north, as are also the 94,000 persons of Italian blood. There are many Negroes and mulattoes, and a so-called Moorish population. This is a mixture of all the races that have successively settled in Tunisia.

DISCOVERY OF RUBBER IN DECAYED BARK

CHANCE discovery of threads of good rubber in a bit of rotting bark in a Haitian forest may eventually mean restoration to favor of the Castilla rubber tree, once a prime source of the bouncy gum but displaced by Hevea because the latter could be tapped more successfully. That we can develop a method for mincing up Castilla bark and getting the bits of rubber out whole, as is now done with the guayule shrub, this disregarded tree may again become a practicable commercial source, is suggested by Dr. O. F. Cook, of the U. S. Department of Agriculture.

Hevea displaced Castilla as a plantation tree because it can be milked every day, whereas the latter tree yields copiously on the first tapping but after that "dries up" and gives no more latex. Harvesting Castilla rubber in the wild, therefore, resolved itself into a very destructive affair. The trees were cut down, the trunk and larger limbs ringed with cuts, and all the latex thus extracted at once. The dead trees were left to lie where they fell. If it proves possible to make an economic extraction of rubber from the bark, after taking the latex by the conventional tapping, the yield of Castilla may be increased to a point of economic justification.

There appears to be an enzyme in Castilla sap, which destroys the rubber if it has a chance to act on it. Dr. Cook suggests that this enzyme could be destroyed by heating, merely by building a light brush fire around the felled trees while they are still green. Then the bark could be stripped and processed whenever convenient.

WINTER FOOD OF GAME BIRDS

WEED seeds are turned into meat by game birds; they form the chief winter food of several species, according to studies by Philip S. Baumgras, of the Michigan Department of Conservation. Mr. Baumgras's report will be printed in full in the *Journal of Wildlife Management*.

That bane of hayfever sufferers, low ragweed, turns out to have some use after all. It yields the biggest supply of winter feed for the birds, as indicated not only by a study of pheasant crop contents, but by careful hand harvesting and weighing of ragweed seed from a number of typical Midwestern field environments. Wheat stubble fields were an especially rich source, yielding an average of 205 pounds an acre in October. Other weed seed serving as winter food for wildlife species include foxtail grass, lambsquarters, black bindweed, smartweed, barnyard grass, finger grass and pigweed.

Wild birds and small game animals are good gleaners of grain left in the field after harvest. In the fields studied by Mr. Baumgras there was an average of nearly seven bushels of corn left unpicked by the mechanical harvester. Most of this was salvaged by livestock; the remainder was used by wildlife. Pheasants especially like corn, though it is not always the best food for them. Squirrels go after it, too, especially when the crop of acorns and beechnuts is short.

Wheat fields cut with a tractor-drawn binder yielded nearly two and a half bushels of waste grain per acre, and oat fields a bushel more than that. This scattered grain was picked up mainly by starlings and blackbirds, but to some extent by pheasants and ducks.

ITEMS

HOPE for a raw-egg-white cure of cancer should not soar too high on the basis of New York research reported from Chicago. Future publications are sure to give the negative side of this line of attack. The method is being studied in several scientific institutions which will report their findings as soon as sufficient studies have been made to warrant drawing conclusions. The raw-egg-white treatment is based on the theory that, since a high content of the vitamin chemical, biotin, has been found in cancer tissues, treatment with raw egg white should be beneficial because raw egg white contains an anti-biotin chemical, avidin. The raw egg white, according to this theory, would destroy the biotin believed by some to be necessary to the life of the cancer. Biotin, according to previously published reports, favors the development of one kind of liver cancer in rats. Its exact role in human cancer has not yet been determined. Efforts to reduce the amount of biotin in the human body by means of raw egg white are not without danger. A vitamin hunger disease, technically termed biotin deficiency, with symptoms strikingly like those of vitamin hunger diseases due to vitamin lack from poor diet, has been produced in humans by large doses of egg whites.

THE U. S. Department of Agriculture, which produced sheer cotton hose when silk grew scarce, is now experimenting with substitutes for sheer cotton. At the experimental hosiery mill at Beltsville, Md., government technicians are trying to make elastic, durable hose from medium-length fibers, now that most of the long-staple cotton is needed for parachute harnesses, airplane cloth and other war fabrics. Most of the cotton mesh or ribbed hose now being sold are made of fine two-ply yarn from long-staple fibers. They are also original government designs or adaptations of them. Present research aims to increase the strength and elasticity of single-ply yarn by means of high twist and chemical finishes. The results may not be so sheer, but they will be practical.

IN Crawford County, Ark., where spinach growing is a really big-time industry, some 13,000 acres were planted very early last fall, in hopes of getting an extra cutting early in the season. What happened instead was a terrific epidemic of a fungus disease, downy mildew, which took from a third to a half of the first cutting. According to Dr. Seth Barton Locke, of the Arkansas Agricultural Experiment Station, the too-early planting gave the fungus its chance. The epidemic died down by mid-December, but dead leaves around the bases of the plants were found to be carrying an abundance of spores, ready to start mischief again when the weather warms up.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE SUPPLY OF PHYSICIANS

A FIRST step toward solving the problem of estimating how many physicians can be taken by the armed forces and still leave enough in a community to satisfy present demands for physicians' services is now available through a study of the Washington, D. C., the Baltimore and the Maryland situation.

The study, by Dr. Antonio Ciocco and Isidore Altman, of the National Institute of Health, U. S. Public Health Service, is reported in the *Journal* of the American Medical Association.

From information furnished by about two thirds of the physicians of the two cities and one state for one week in early fall, 1942, it was possible to determine the present number of patients seen in one week by doctors of various age groups, male and female, Negro and white, and in general practice or specialties. Among many significant facts, the study shows the following:

General practitioners under 45 years of age, the group the armed forces are drawing on, have a patient load 25 to 50 per cent. greater than those between 45 and 64 years and more than twice as large as that of doctors 65 years and older.

This age difference is important because, as the statisticians point out, "in a community containing two physicians, one 35 and the other 65 years of age, one could maintain that the removal of the younger man will mean the loss of not one half but of two thirds of the physicians."

General practitioners who spend eight hours in their office daily see on the average 140 patients weekly. Those who spend nine hours can be assumed to see an average of 158 patients weekly. On the basis of the figures, a weekly average patient load of 140 would require a ratio of one physician to 960 persons in Washington, D. C.; one to 970 persons in Baltimore, and one to 1,135 in Maryland.

A weekly average patient load of 140 for Washington, D. C., means an increase of about 22 per cent. over the present patient load or, considering the ages of the remaining general practitioners, since some younger doctors have already been taken into the armed forces, an increase of about 26 per cent.

If an average weekly patient load of 160 is considered as a maximum, giving a ratio of one physician to 1,060 persons in the nation's capital, the increase over the present patient load, taking into account the ages of the remaining general practitioners, becomes 48 per cent.

It is pointed out that the present average patient load already represents an increase of perhaps 25 per cent. over that of 1940. Increasing the patient load of a group of physicians by 40 per cent. over that of the present actually increases it by about 75 per cent. over that of 1940. Therefore, the pertinent question to be asked is, "before accepting any proposed value of the maximum patient load, is whether or not the remaining physicians are able to sustain the added burden."

TUBERCULOSIS

TUBERCULOSIS will become a plague affecting approximately 10,000,000 persons in Europe after the war, is stated by Dr. Robert E. Plunkett, general superintendent of tuberculosis hospitals for the New York State Department of Health, in a report to the *Bulletin* of the National Tuberculosis Association.

A three-point program by which the United States could help check this anticipated plague was outlined by Dr. Plunkett as follows:

1. Governmental and private agencies dealing with tuberculosis in this country can appraise the problem and develop the control program, for which public or private funds or both could be used.

2. Many American physicians and X-ray technicians who are gaining tuberculosis experience and training with the armed forces during the war could be available for post-war service abroad, since not all of them could find work in the anti-tuberculosis fight here.

3. Some of the vast amount of X-ray equipment acquired by the armed forces for chest X-raying of men entering the services could be assigned or contributed to foreign service since not all of it will be needed here at home after the war.

Dr. William Charles White, chairman of the National Tuberculosis Association's committee on medical research, announced that a new tuberculosis research program has been initiated as a result of the chest X-rays for detection of tuberculosis given the millions of men entering the armed forces. The work is being done under the direction of Dr. Carroll E. Palmer and Dr. Herman E. Hilleboe, of the U. S. Public Health Service, with financial aid from the National Tuberculosis Association.

The object is to discover the constitutional factors that decide whether or not a person will be able to resist the tuberculosis germ invasion. Student nurses have been selected for the study because they are subjected to frequent contact with active cases of tuberculosis and can be examined at short intervals during their three years period of training.

Only when the factors of constitutional resistance are known will it be possible to prescribe the right treatment for each individual case of tuberculosis. At present, the only safe procedure for all cases in the earliest stages is immediate and complete rest in bed.

How to prescribe the right treatment for each man rejected by the armed forces because of very early tuberculosis is, according to Dr. White, the most pressing current tuberculosis problem.

A POSSIBLE SUBSTITUTE FOR BLOOD PLASMA

A POSSIBLE substitute or supplement for blood plasma in treating shock from hemorrhage in war wounds in case of shortages of plasma is announced by Dr. Robert Elman and Dr. Carl E. Lischer, of Washington University School

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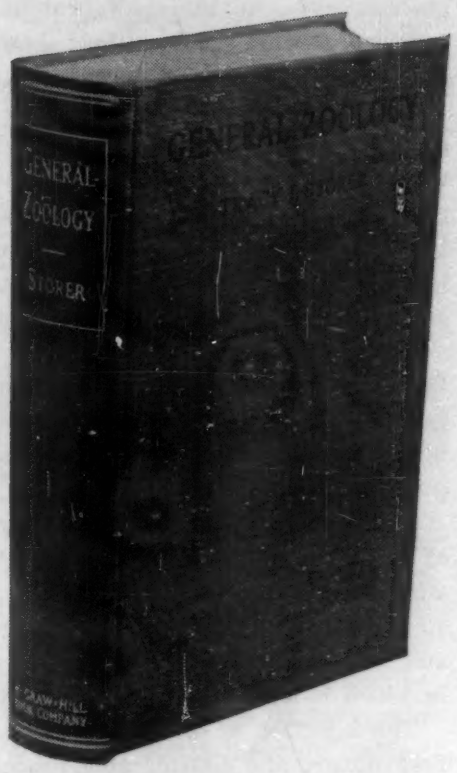
GENERAL ZOOLOGY



By TRACY I. STORER

Professor of Zoology, University of California at Davis

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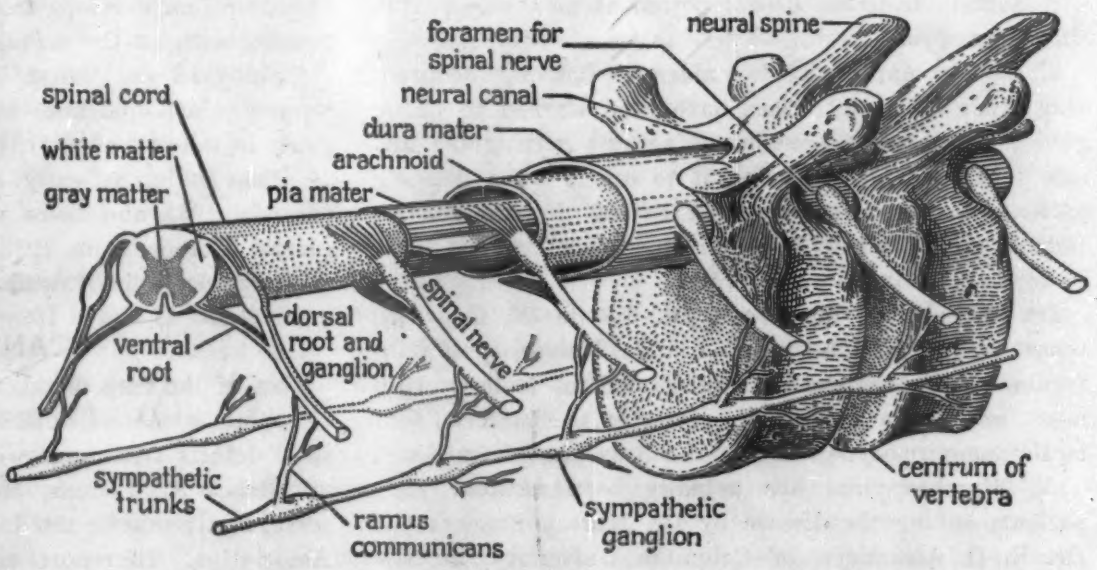
IN this new basic text of unusual importance the author presents an introduction to zoology designed for a "types" course. The book provides both a general biological approach and a systematic review, in order to give the student a rational understanding of the structure, function, and life characteristics of animals, as well as an orderly knowledge of animal types. The author has made a special effort to treat animals as they live in nature rather than as dead specimens in the laboratory. The illustrations, the majority of which are entirely new, are outstanding. Most of the anatomical figures have been drawn directly from dissections made under the author's immediate direction, and are shown from the left side in each case to facilitate comparison.

The human spinal cord, spinal nerves, and sympathetic nervous system and their relation to the vertebrae and the membranes (meninges) about the cord. An example of the distinctive anatomical figures in *General Zoology*.



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of Medicine and Barnes Hospital, St. Louis, in the *Journal* of the American Medical Association.

The substitute would be a solution of hydrolyzed proteins, enzymatically digested, from either beef blood plasma or casein, the chief protein of milk. In laboratory experiments such solutions showed themselves as good as blood plasma for treatment of animals in shock from repeated hemorrhage. The animals that got the protein solutions survived for a 50 per cent. longer time and could withstand 25 per cent. greater blood loss than untreated animals, and their blood pressures also stayed at higher levels. Solutions made from pure crystals of all the essential amino acids also were definitely beneficial but not as markedly as the solutions of hydrolyzed proteins.

Caution is needed before the encouraging results of these experiments can be applied to treatment of human patients suffering surgical shock from hemorrhage, but it is believed that further study is justified because of the practical advantages such solutions offer.

It is pointed out that while plasma and whole blood are of vast importance in the treatment of shock, it is probable that in wartime the number requiring such treatment might well exceed the available supplies of plasma and that in the armed forces many situations might arise in which blood donors were not available.

The injection of one quart of plasma requires bleeding four donors and considerable processing, not to mention the transport and storage space problems. Solutions of amino acids and hydrolized proteins, on the other hand, are as convenient to give as sugar and salt solutions.

"SHIPYARD EYE"

THE latest developments in the "shipyard eye" situation are:

1. The cause of the disease, which has been striking in epidemic form at industrial as well as shipyard workers on the East and West Coasts, has been fairly clearly identified as a virus through studies by two groups of medical researchers.

2. Sulfathiazole has been reported as an "almost specific" remedy.

3. Doctors, nurses and first aiders in Detroit, and probably other industrial areas, have been warned to be on guard, taking extra precautions against getting the disease themselves or spreading it to others when treating patients having or suspected of having the disease. In Detroit the Board of Health is requiring that all cases be reported to it.

Dr. Michael J. Hogan and Dr. Joseph W. Crawford report that in 125 cases studied at the University of California Medical School in San Francisco, undernourishment, occupation and disease germs of the bacteria, that is, the non-virus type, were ruled out as possible causes.

A filterable virus has actually been isolated from patients having the disease by Dr. Murray Sanders and Dr. R. C. Alexander, of Columbia University, in New York. Their studies were carried on in "informal collaboration with the Commission on Neurotropic Virus Diseases, Board for the Investigation and Control of Influenza and Other Epidemic Diseases in the United States Army."

The virus they isolated caused "shipyard eye" when rubbed in the eye of a healthy young men who volunteered for the test. Blood from convalescent patients in New York and California neutralized this virus. The virus was shown to be different from other disease viruses by further neutralization tests and by difference in size as measured by the bore of the filter through which it could pass. The results are printed in the *Journal of Experimental Medicine*.

Successful use of a 4 per cent. or 5 per cent. solution of sodium sulfathiazole sesquihydrate in treating cases of "shipyard eye" at the County Hospital in San Diego, Calif., was reported by Dr. F. J. Walter to the *Journal* of the American Medical Association. If further trial shows that this is, as Dr. Walter calls it, "almost specific" as a remedy for the condition, it will be one of the few instances in which a sulfa drug has succeeded as a remedy for a virus-caused condition.

"Shipyard eye," known medically as kerato-conjunctivitis, is highly contagious, according to a report from the Wayne County, Mich., Medical Society. About five out of every 100 persons develop the disease. In spite of its popular name and its outbreaks among industrial workers, the highest infection rate in a recent epidemic was among the doctors and nurses in the affected industry. Housewives, druggists, dentists, bankers and business men have also caught the disease.

The disease might at first be mistaken for "pink eye," and sometimes the patient thinks his trouble comes from something getting in his eye, which is one reason why doctors, nurses and even first aiders are warned to be suspicious and take special precautions against the danger of unknowingly spreading the infection. Inflammation of the mucous membrane, swollen eyelids, watering of the eyes, sometimes with bloody tears, sticking of the lids in the morning and inflammation of the cornea are among the symptoms. Eyesight may be impaired in as many as half the cases, but Dr. Hogan and Dr. Crawford state that permanent impairment of vision is not likely. The condition develops from five to eight days after exposure, lasts, on the average, 10 days to three weeks.

"Shipyard eye" first became headline news in this country when epidemics broke out in West Coast shipyards in the fall of 1941, but it occurred in Bombay and Madras, India, as early as 1920. London had a few cases in 1933 and there were wide-spread epidemics in central Europe from 1932 through 1940. There was a severe epidemic in Hawaii in 1941.—JANE STAFFORD.

TANTALUM

USE of the rare metal, tantalum, for plates and disks to replace pieces of skull lost in war wounds or to cover skull defects from such wounds, is proposed by Lieutenant Robert H. Pudenz, Medical Corps, U. S. Naval Reserve, in a report to the *Journal* of the American Medical Association. He reports success with this use of tantalum in laboratory experiments and referred to as yet unpublished reports from other surgeons who have used it successfully on human patients.

Tantalum is a bluish white metal resembling steel in its physical properties and glass in its chemical characteris-

ties. An important advantage of the metal for surgical use is the fact that it can be drawn into wire or rolled into sheet while cold. Because it is easily malleable, the surgeon can cut and mold a piece of tantalum to the desired shape at the operating table.

In addition, tantalum does not corrode, is not poisonous, does not cause any adverse reaction with the body tissues and is non-absorbable. It is heavy, with an atomic weight about three times that of iron, but because it can be used in a thin sheet its weight is apparently not a disadvantage. None of the patients who have had skull defects repaired with it has, so far as is known, felt any sensation of heaviness or pressure.

Tantalum has previously been used for bone plates and screws and wires in both animal and human tissue. Bone, cartilage, celluloid and the metal, vitallium, have all been used to repair skull defects. Vitallium has recently found most favor with brain surgeons, but tantalum has the advantage of being easily malleable.

ANTI-FREEZE SOLUTIONS

AVOID the danger to your car that may come from the use of calcium chloride or other salt in an anti-freeze solution for its cooling system, is the advice of automotive engineers of the National Bureau of Standards.

These engineers, who made a special study of this matter, call attention to the danger due to hidden corrosion. The use of salt solutions is prohibited in all government-owned motor vehicles.

Salt solutions have been tried ever since automobiles were first driven in freezing temperatures. Damage always resulted if the solutions were in the cooling system for more than very short periods. Salts cause corrosion. Water pumps and cylinder heads, particularly where the latter were of aluminum alloys, developed leaks which showed up only after the damage had been done.

With the present shortage of the more commonly used anti-freeze solutions, salt solutions are now being offered. Some contain inhibitors which it is claimed will protect against corrosion. The Bureau of Standards engineers do not know of any inhibitor effective under ordinary winter driving conditions.

There are a few simple tests that may be made to determine if an anti-freeze solution probably is based on calcium chloride or any other salt. The first is by weight. If a gallon of the solution weighs over 10.5 pounds, it is probably a salt solution.

A half-cupful may be boiled slowly in an iron skillet until dried. If a substantial deposit is left in the skillet it is probably salt. Two spoonfuls of the solution may be put in a glass and a drop or two of silver nitrate added. A whitish deposit or cloud will indicate calcium chloride or other salt.

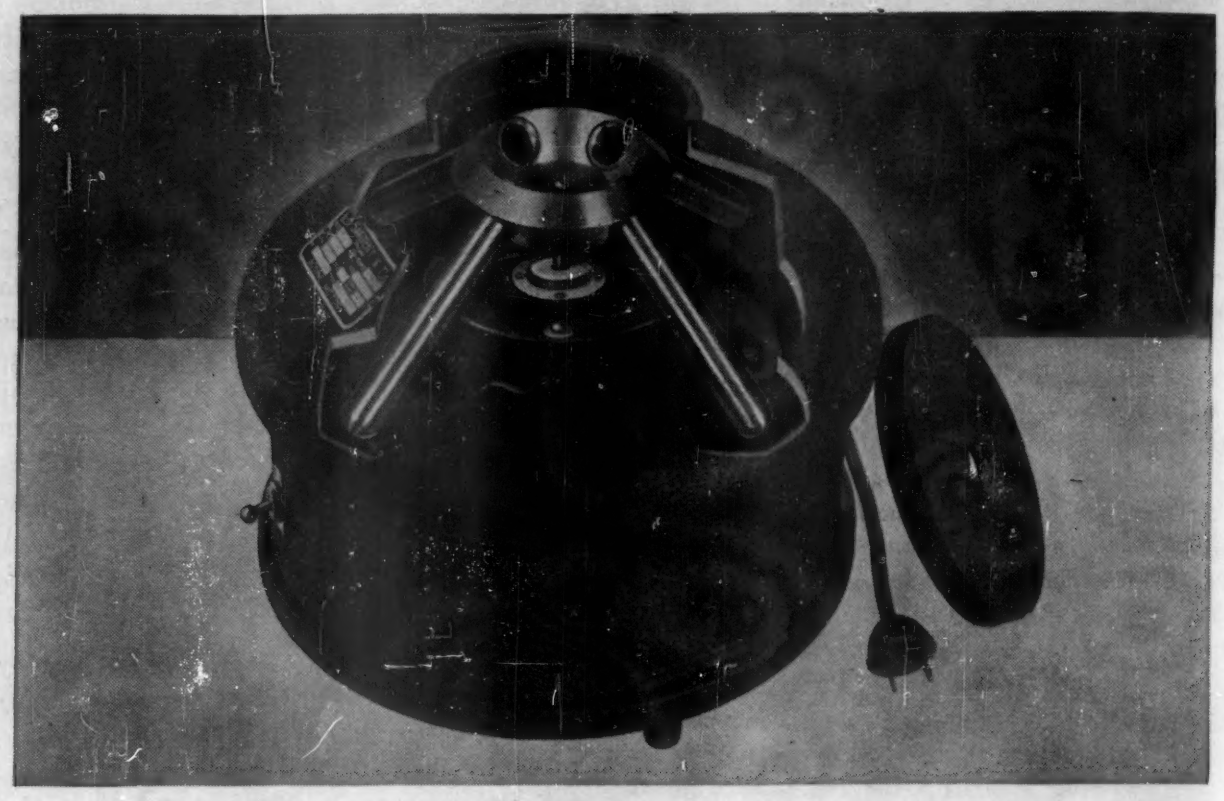
The advice of the Bureau of Standards with regard to any radiator preparation of unknown composition is to analyze it or to avoid it.

ITEMS

THE great-grand-uncle of all frogs, a giant amphibian with a skull more than two feet long and a foot and a half wide, that lived in Texas some 250 million years ago, more or less, is described and given scientific christening in the current issue of the *Journal of Geology*, by Professor Alfred S. Romer and Robert V. Witter, of Harvard University. Although the creature is definitely identified as an amphibian, it had a well-developed array of teeth in both jaws, and at least part of its skin was beset with bony scales. Since modern frogs and toads have neither teeth nor scales, the kinship of this ancient giant of their tribe must be regarded as avuncular rather than directly ancestral; though Professor Romer does state that the frogs are probably related to the extinct group of which this big amphibian is a member. The fragmentary remains of several of these animals were found in the lower levels of strata known to geologists as the Texas red beds, which gives them a geologic age about where Carboniferous and Permian meet. The genus has been given the scientific name Edops cragei.

SUGAR, potatoes and other sweet and starchy foods belonging to the carbohydrate class may not be necessary as such in the diet, is reported in the *Bulletin* of the Johns Hopkins Hospital by Dr. Richard H. Follis, Jr., and Dr. William M. Straight, of the Johns Hopkins School of Medicine. They found that laboratory rats could live and grow on a purified diet completely lacking in carbohydrate, though containing all essential vitamins, minerals, protein and fat. The rats not only thrived but seemed active and normal in every respect. Microscopical examinations of the tissues of the animals after death showed no significant differences from animals that were fed carbohydrate. Carbohydrate is needed by the body to furnish energy and for the utilization of fat, but rats apparently can manufacture all they need of this from protein and probably also from fat. The findings may not, however, apply to man or other species of animals, since a case has been reported abroad of an attempt to raise a human baby from birth on a "practically carbohydrate-free" diet. At ten months the child developed ketosis, a condition signifying disturbance of liver function, and the experiment was stopped.

WIRED-RADIO programs are now given in several Army camps by the U.S.O. for the entertainment of the soldiers. The equipment is operated by the Army, which uses it for other purposes as well. Civilian defense units are using the wired-radio in their work in a number of key cities. So it may be said to be playing its part in the nation's war effort. Wired-radio programs are distributed over power lines instead of being radiated through space by means of transmitting antennae. They are picked up with the ordinary broadcast receiver. They are particularly of interest to communities not in the primary service area of any long-wave broadcasting station. Forty stations could operate at the same time on the broadcast band in any locality without interaction with nearby similar systems, according to *Electronics*. It is being used by several colleges and might be used by fire and police departments.



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SCIENCE NEWS

Science Service, Washington, D. C.

THORIUM

DISCOVERY of the rare radioactive element thorium in the sun is announced by Dr. Charlotte E. Moore, of the Princeton University Observatory, and Dr. Arthur S. King, of the spectroscopic laboratory at Mt. Wilson. The element was found to occur in the ionized state only.

Although search for thorium started in 1938, the investigation was hindered by lack of suitable experimental work on the spectrum of the element in the laboratory under different conditions of temperature and magnetic field strength. When such experimental work recently became available the search was begun anew and this time was successful.

The basis for the discovery was chiefly the detection of lines in the solar spectrum that matched the lines of thorium most easily produced in the laboratory and which are generally the strongest lines of an element. These are known as its ultimate lines and if they are absent it is hopeless to look for any others.

One line of thorium which stood out in strength above all others and was therefore believed to be its ultimate line coincided almost exactly with a faint unidentified line in the solar spectrum. Other strong lines of the ionized element could only be tentatively identified with solar lines. But as the very strongest line of thorium is represented so weakly in the sun the absence of the other lines is not considered surprising.

Two of the strongest lines of neutral thorium coincided with solar lines, but the agreement was believed to be accidental from another line of evidence. Since sunspots are about 1,500 degrees Centigrade cooler than the surface of the sun surrounding them, they should contain less ionized thorium and consequently more of the neutral atoms. Hence, if the lines really belonged to thorium, they should be strengthened in the spectrum of sunspots. But since the lines were not strengthened in the sunspot spectrum the investigators were forced to reject the coincidences as accidental.

SCIENCE, SOCIAL SCIENCE AND THE HUMANITIES

THE physical sciences, necessarily given priority in present-day training programs to meet the war emergency, will not dominate post-war education, Dr. James B. Conant, president of Harvard University, emphasized in an address before the New York Academy of Public Education. They will maintain the gains they are making, but the social sciences and humanities will have to catch up with them, to maintain a balanced and a livable world.

The old notion that there is a basic opposition between two kinds of training, and that one kind is parasitic on the other, was decried by the speaker. The real relation, he said, is not one of parasitism but of symbiosis—the kind of thing you have in a lichen, in which two quite different types of organism are mutually beneficial to each other.

Such a symbiosis has long obtained in human affairs, Dr. Conant continued. Historically, the system of political liberalism under which we live has made scientific advance possible; and in turn scientific advances have fed our sense of freedom. "If we are to have a free society on this continent we must continue to have advances in the fundamental sciences, and these advances in turn can take place only if man is free. The symbiosis must continue if this nation is to prosper. . . . Let no man who admires science or extols new industrial techniques look with favor on any abridgment of human liberty unless he wishes to encourage forces which will eventually destroy those things he values most." He emphasized the necessity for post-war planning, if only to avoid further wars: "We can not maintain a free society in a world in which we must face the terrible and disrupting burdens of modern war once every generation."

In concluding, he offered a five-point outline of a master plan for future research: (1) Provide an educational system which offers real equality of opportunity. (2) Find the exceptional men among those given this opportunity while they are still in training. (3) Give these men every advantage and facility in the way of machines and helping hands. (4) Be certain that there are many rival and independent groups competing for scientific and technical achievement, and that no group can long perpetuate itself. And finally, (5) Beware in times of peace of coordinating agencies with dictatorial powers—of ideas of a peacetime scientific general staff.

THE ACCURACY OF MEASUREMENT

THE 52,000-ton full-load displacement of the new "Iowa" class battleships may actually be as much as 52,052 tons or only 51,948 tons without any one knowing the difference. That a battleship can not be weighed with an accuracy closer than one part in a thousand, was pointed out by Dr. Harvey L. Curtis, of the National Bureau of Standards, in his address as retiring president of the Washington Academy of Sciences. By contrast, a kilogram weight (basic unit of the metric system, a little more than two English pounds) can be compared with another with an accuracy a little less than one part in a billion.

Biggest things and smallest things are most difficult to measure and weigh. A battleship is about the biggest lump of matter which human means can weigh directly. In the opposite direction, the antipneumococcus germ or virus particle is among the smallest of living things. It would require one octillion of these to weigh as much as a blue whale, largest of all animals. Far below this tiniest of germs, however, is the electron, smallest of all known objects. Its mass has been determined within an error of one per cent—but this is an accuracy of only one part in a hundred, as compared with one in a billion when kilogram weights are being compared.

As with weights, so with lengths. The standard meter

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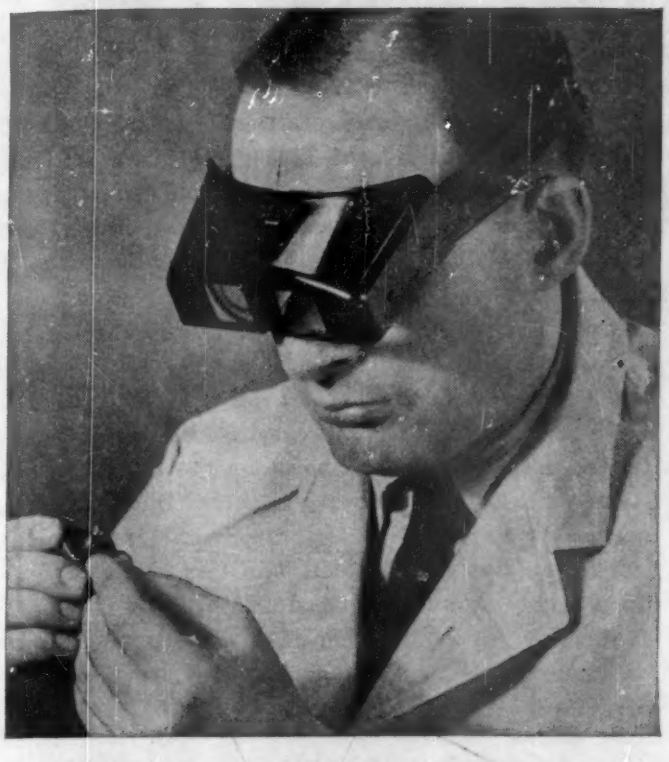

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bar (the laboratory's "yardstick") can be compared with another meter bar with an accuracy of one part in ten million, perhaps under very favorable conditions to one part in fifty million. The error amounts to something between a twentieth and a hundredth of the diameter of a fine spiderweb.

Accuracy of comparisons falls off with either increase or decrease in lengths being compared. The standard base line used in the most accurate kind of surveying is usually 1,000 meters. Its accuracy, however, can be determined only to one part in a million, as compared with one in ten million for the single meter.

The millimeter (a thousandth of a meter) can be determined with an accuracy of only one part in a few hundred thousand. The distance between the nuclei of a hydrogen molecule is known only to one part in a thousand, while the diameter of a proton, the smallest known object, has not yet been determined within an error of less than one part in ten.

ALASKA HIGHWAY CONSTRUCTION

OLD-TIMERS in Alaska and the mountain country of western Canada declared that a road couldn't be built where the Army Engineer Corps planned to put it, but airplane reconnaissance found a way through, and "guts and tractors" built the road.

This, in a one-sentence summary, tells the story of the building of the Alcan Highway, which was presented at greater length before a joint meeting of the American Philosophical Society and the Geographical Society of Philadelphia on February 18 by Major Roswell P. Rosengren, chief of the Office of Technical Information.

The story of the road is a saga of decision, speed and determination. Only a little more than a year ago, on February 2, 1942, Brig. Gen. C. L. Sturdevant, of the Engineers, was told that a road was to be built and instructed to bring in preliminary plans. Forty-eight hours later he submitted them. He received from the Army High Command a directive on February 14 to proceed with the project.

The Canadian Government immediately gave informal permission for survey parties to go to work in their territory, and this was made formal on February 26. By March 10, American troops were arriving at the railhead at Dawson Creek, B. C., in temperature around 40 degrees below zero Fahrenheit. Further contingents reached other construction centers during April.

The route selected was criticized by local men who thought they knew the country because a considerable part of it apparently would have to traverse a 6,000 foot plateau. Actually, the airplane parties found a route no part of which had to climb above a 4,000 foot altitude. All of it lies in timbered country.

Several engineer regiments (one of them colored) tackled the job which looked like one to daunt Hercules. Each regiment moved up "heavy artillery" in the form of 44 big tractor-bulldozers, with scores of trucks, power shovels, piledrivers and other machinery; and of course the omnipresent, indispensable jeeps. The country fought the invaders with miles and miles of sullen muck and millions of mosquitoes. The road, as one writer put it, "was built as in battle, with every hardship except bullets." And the Corps of Engineers, U. S. Army, won their fight.

ITEMS

THAT the first sunspot of the new cycle may have already appeared, nearly a year before the end of the present cycle, it has been announced by Dr. Seth B. Nicholson, of the Mt. Wilson Observatory. The spot-group was visible for one day only on December 20, 1942, in the relatively high latitude of 32 degrees north, on the sun's surface. One of the most fundamental characteristics of the solar cycle is that toward the end spots are confined to a belt about 10 degrees wide on either side of the sun's equator. But when spots of the new cycle appear they are much farther from the equator than the old, usually above latitude 25 degrees, as was the case of the short-lived group of December 20. As a rule, the cycle to which a spot-group belongs can be decided definitely from its magnetic polarity as shown by the preceding and following members as they move across the sun's disk, the magnetic polarity of spot-groups of one cycle being opposite to those of the next. But in this particular case, the preceding spot was so little in advance of the other that it was hard to say whether the group should be classified as having a polarity the same as other spots of this cycle or not.

ABOUT three fourths of the moon was blacked out by the shadow of the earth on Friday night, February 19—the last lunar eclipse that will be visible in the United States until 1945. A nick appeared in the lower left edge of the moon three minutes after midnight. By 1: 38 A.M. Saturday it was nearly immersed in shadow. A dull, coppery glow covered the eclipsed portion because some light is bent into the shadow as the rays pass through the earth's atmosphere. Since blue waves of light are scattered by passage through the air, giving the sky its blue color, light which reaches the moon has a preponderance of red waves, causing the copperish hue. The eclipse was observed until 3: 13 A.M.

THAT cold wave we've just been through wasn't a local affair. It covered pretty much the entire country east of the Rockies, according to the U. S. Weather Bureau. And it was the coldest weather we've had this winter. Temperatures ran as much as 12 degrees below normal, as contrasted with 10 or 15 degrees above normal during the previous week. Drops to 20 and 25 degrees below zero Fahrenheit were common in the north central states, and even as far down the map as central Georgia there were freezes at 10 or 15 degrees above zero. A good deal of harm may have been done to growing vegetable crops and dormant fruit buds in the South, but the extent of the damage has not yet been determined. Stock in the Northwest suffered from cold and deep snow, and there seems to have been some killing of uncovered winter grains, especially in the southern Plains region. And through it all, the Far West basked in temperatures well above normal for the season.

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SCIENCE NEWS

Science Service, Washington, D. C.

BIOLOGY, THE SCIENCE OF PEACE

BIOLOGY, unlike physics and chemistry, has not been heavily drawn upon in the service of war, Dr. Edwin Grant Conklin, president of the American Philosophical Society and of Science Service, pointed out in an address on March 1 given before the Science Talent Institute, attended by the forty topflight high school Seniors, in Washington to compete for scholarship prizes in the Second Annual Science Talent Search.

Biology is the science of peace, Dr. Conklin emphasized; it is the science of life rather than of death. Biologists have been left at their normal posts, to teach medical students and to carry on research in agriculture, nutrition and public health.

Dr. Conklin pointed out that "Biology is in times of war less applied than these other subjects, but it is no less important. Nothing concerns man so much as understanding life—his own life and that of animals and plants. The great lesson of evolution is not that we are descended from monkeys (which we are not), but the fact that all life, that of plants, animals and men, is fundamentally alike."

The speaker warned his young hearers against the heresy, too prevalent in the period between the two World Wars, that the chief aim of science is material success in war or in peace. He challenged them to produce from their ranks a new Darwin who will discover the unknown factors of evolution, a new Pasteur who will demonstrate the causes of cancer, a new Columbus of biology who will venture out on the dark unknown sea between the living and the non-living and find the connection between them.

VANADIUM IN ANCIENT OCEAN BEDS IN IDAHO AND WYOMING

DEVELOPMENT tunnels to tap a jackpot of the war metal, vanadium, are being driven into the canyon walls of Sublette ridge. This formation, running off the southeastern tip of Idaho into Wyoming, is the site of old ocean beds which it is estimated contain millions of tons of vanadium ore. From it comes the light gray metal used as a toughener for armor plate, guns, machine tools and other victory ingredients.

Discovered by the U. S. Geological Survey, the deposits will go far toward making the nation self-sufficient in this war necessity. Up to this time an important part of our vanadium came across submarine-infested sea routes from foreign mines, mainly in Peru. Utilization of the newly found deposits would free much needed shipping space.

More than two years ago phosphate miners in this region began to recover vanadium as a by-product without knowing of the richer beds which lay near-by. But about this time, W. W. Rubey, of the Geological Survey, searching for phosphate fertilizer, sent in some unimportant-appearing dark shales and mud-stones for analysis. Back came the report on vanadium—a much higher percentage than appeared in the phosphate rock itself.

Then came a tedious period of exploration and sampling. Along a gulch at the foot of Sublette ridge, the searchers came upon the long-abandoned diggings of an old fertilizer prospector. Here a vanadium-rich sample was found which led them to still others. Most of the better analyses seemed to come from one particular bed.

After Pearl Harbor the work was pushed with renewed vigor. Hundreds of old samples were reexamined. With this correlated data, Mr. Rubey again went into the field last spring to test his theory that a single workable vanadium bed of wide extent had been discovered.

Establishing a field laboratory, he took more samples and analyzed them on the spot. Engineers from the Bureau of Mines then came in to cooperate. Finally it was proved that the bed was vanadium-bearing nearly everywhere and its position was carefully mapped. The results were turned over to the Bureau of Mines, the War Production Board and the Metals Reserve Company for action. Secretary Ickes has banned speculative claim-staking to insure rigorous testing and proper public control of this important war project.

SOUTHERN PINE STUMP AND PINE OIL

PINE stump salvaging has become a profitable enterprise in southern states where reduction plants have been established to chew them up and extract their turpentine, resin and pine oil. The plants are working at full speed these days as the war activities use up their products as fast as they can turn them out.

Generally the stumps are left in the ground to rot if the land is to be used for another timber crop. They must be cleared if the land is to be used for farming. Leaving them in the ground or pulling and burning them wastes their valuable resinous and oil contents. Much experimental work has been done during the past two or three decades by the U. S. Department of Agriculture and by private companies interested in naval stores, to find a profitable method of extracting resinous contents for commercial purposes. Processes have now been simplified and a great expansion in the industry may be expected.

Before the stumps are processed they must be thoroughly dried. Usually they are left in the ground to dry. This may take several years. While drying important changes take place in the composition of their resinous contents. Then they are pulled with special machines, loaded on trucks and taken to the mill. They are washed free of all earth in long troughs through which they are dragged on an endless chain in a stream of running water.

The next step is their mastication. They are ground in drums with heavy cutting blades that crush, cut and chew them into small pieces. In another machine they are further shredded into tiny chips. What was once an ungainly stump is now a mass of very small pieces, and ready for the treatment necessary to extract the oil, turpentine and resin. The extraction is accomplished in large tanks, some of which will hold as much as 15 tons

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of the chips. The tanks are sealed and the contents treated with a solvent—benzole, naphtha or other petroleum product—which is steam-heated and forced in under pressure. The solvent mixes with the tiny chips and takes up the resin, turpentine and oil in solution. When the process is completed the liquid is drawn off and the resin-free wood is used for fuel under the boilers of the plant.

The liquid solution is first cooled. A resinous pitch settles which is easily separated. It is sold to foundries where it is used as a core binder. The remaining liquid is separated by distillation. The petroleum solvent is evaporated off first, as it has the lowest boiling point. It is reused. The turpentine is evaporated off next, then the pine oil. The resin is left in the retort, from which it is drained as a heavy fluid that hardens as it cools.

Longleaf pine and slash pine stumps are used in these processes. There are some nine or ten well-equipped plants operated in the country. The uses of turpentine and resin are well known. Pine oil is used in the manufacture of textile sizes, disinfectants, liquid and industrial soaps, and in a variety of sprays. It is used also as a flotation agent in recovering metals in copper refining.

NUTRITIONAL STANDARDS

RECONSTRUCTION in the postwar world, and advances to new achievements in civilization and culture, will depend to a very considerable extent on a high nutritional standard—higher than was ever known in prewar ways, according to Dr. Frank G. Boudreau, executive director of the Milbank Memorial Fund, who spoke at the mid-winter meeting of the American Philosophical Society.

The advantages of abundant nutrition over just-sufficient feeding have been repeatedly demonstrated, both in sociological field observations and in controlled experiments, Dr. Boudreau pointed out. Even with animals the results are beyond argument. Colonies of laboratory rats, descended from long lines of sleek and well-fed ancestors, immediately showed improvements in health, vigor and longevity when they were given extra feedings of vitamins and other health-making factors. As negative evidence, Dr. Boudreau cited the cultural stagnation of the late middle ages and early modern times, when famines occurred on the average of seven times in a century, keeping whole populations hungry as much as a tenth of the time.

If we are to move forward into the gleaming civilization that forward-looking statesmen see for us beyond the present smoky horizon, we shall have to see to it that the American people, to say nothing of the rest of the world, receive far better nutrition than the average American prewar diet represented. Prewar consumption, on the basis of careful studies by the Food and Nutrition Board of the National Research Council, showed some astonishing lacks, for a people who boasted themselves the best fed in the world. From the diet designated by the National Research Council studies as best adapted, the following deficiencies were noted: 59 per cent. in leafy green and yellow vegetables, of 45 per cent. in milk, 28 per cent. in citrus fruits and tomatoes, 25 per cent. in beans, peas, and nuts, 17 per cent. in eggs, 14 per cent. in tomatoes, 4 per cent. in meat, poultry, and fish, and 2 per cent. in flour and other cereals. There was an excess production of 8 per cent. in butter and other fats and of 15 per cent. in sugar.

To right this, even for the United States alone, will require a reorientation of our agriculture that is not much short of a revolution.

ITEMS

EVIDENCE that luminous hydrogen gas is streaming from a faint star known to astronomers as HD 242257 in the constellation of Auriga, the Charioteer, at the rate of 1,200,000 miles an hour, has been obtained by Dr. Paul W. Merrill, of the Mount Wilson Observatory. If the sun were expanding with the same speed it would swell to the size of the earth's orbit in three days. The evidence is based upon photographs of the spectrum of the star taken with the 100-inch reflecting telescope. Dr. Merrill suggests that possibly forces are at work in the atmosphere of the star similar in nature to those that cause sudden eruptions of vast clouds from the surface of our sun. "So far as I am aware, no other star except a nova is known to be surrounded by an atmospheric shell of hydrogen expanding at so tremendous a rate," said Dr. Merrill.

WAR plane output is being speeded by the production of aircraft parts by thousands of factories scattered throughout the country. These converted plants are assisted in their war work by the use of standard specifications distributed by the Society of Automotive Engineers. The specifications include precise engineering instructions covering processes and materials, types, qualities and tolerances. They have enabled widely separated plants to turn out standard aircraft parts which on the assembly line in the warplane factory are used in the assembling of the completed plane. Metallurgists and materials engineers representing the aircraft industries, and Army and Navy officials cooperated in writing the specifications. Some 283 specifications have been completed. Others are in preparation. Nearly half of those originally issued have been revised to meet newer aircraft specifications.

ABOUT 36,000 residents of Washington, D. C., most of them employees of the Federal Government, have been vaccinated against smallpox since last December, has been announced by the District of Columbia Health Department. About 10,000 of these vaccinations were given by physicians of the health department and the rest by the medical staffs of various Federal and District agencies. The outbreak of smallpox in near-by Pennsylvania stimulated the current vaccination drive, but Dr. George C. Ruhland, health officer of the District of Columbia, is still urging that all persons living there who have never been vaccinated should take this health protection immediately. The reason is that Washington is the crossroads of the world in war activities. People are coming not only from the entire nation but from all over the world, many of them from regions where vaccination against smallpox is not practiced, and this increases the danger to unvaccinated persons there. No case of smallpox has been reported in that city in the past 10 years.

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SCIENCE NEWS

Science Service, Washington, D. C.

EINSTEIN'S THEORY OF GRAVITATION

DR. GEORGE D. BIRKHOFF, professor of mathematics at Harvard University, before a scientific audience at the University of Cincinnati in a lecture which is also to be delivered before local chapters of the honor society Sigma Xi throughout the country, stated that Einstein's theory of gravitation, although it provides a satisfactory explanation of gravitational phenomena is "essentially unworkable." Dr. Birkhoff pointed out that all the newer theories of quantum physics are found inadequate as they can not be fitted into a satisfactory explanation of the universe.

To the physicist, this larger view of nature seems unnecessary. It is sufficient if he can by means of his theory calculate results that can be verified by scientific experiment. The mathematician, on the other hand, wants to understand how each theory fits into his whole knowledge of nature. When the theories were not developed from the simple aspects of nature—objects, sequences of events, or geometric forms that can be recognized—but have been created by the human mind, then the mathematician wants to be able to build a physical model to fit the theory.

It is not possible, according to Professor Birkhoff, to build any such tangible model from the modern theories of quantum mechanics. It may be true, he said, in some mystical sense that God thinks multi-dimensionally whereas men can only think in a series of logical steps along a line. We need a satisfactory mathematical theory to remedy our deficiency in this respect.

The way mathematical concepts and theories have been developed from simple experiences of nature was described: "A child puts its hand too near the fire and is burned, and thereafter remembers that this A (touching fire) will bring about this B (pain and burn). The chain of association fixed in his memory is essentially of the propositional type 'A implies B.' He has learned a physical fact!" This is the basis of logic. "The boy playing with a pile of pebbles on the seashore is dealing with a universe of distinguishable objects just as was the shepherd in ancient times who counted his flock by means of stones. In this simple process of one-to-one correspondence lies a basic difference between man and all other animals." This is the basis for the concept of number.

Geometry arises from the idealization of physical bodies which are taken to be rigid forms and is practiced by the use of such simple "rigid bodies" as the ruler and protractor.

With only these three examples before them, mathematicians have set out to generalize and to modify. More recently they have added the concepts of time and a system of forces. From these have been built the framework of the universe of space and time.

FOOD PRODUCTION IN FRENCH NORTH AFRICA

AGRICULTURAL North Africa may this year produce foods to take care of its native population and to feed the Allied troops in the area if crops can be planted during the next month or two. Seeds, fertilizers, and farm machinery and repair parts are the essential needs. Irrigation systems must be restored. Drainage and soil improvement are necessary. Fuel for tractors and farm trucks must be supplied.

American and British food in large quantities is now being shipped to French Morocco, Algeria and Tunisia. The Allied troops, American, British and French, must be fed. The starving civilian population must have food if full cooperation is to be obtained. Considerably over a million tons of grains, meats and other foodstuffs were taken out of these countries in 1941 to feed the Axis, including Rommel's forces in Africa. Large quantities were taken again last year. Little was left for the home people.

In the past these French North Africa countries produced much more food than was needed locally. During the four-year period beginning in 1934 they exported each year approximately 2,500,000 tons of food and nearly 1,500,000 tons of wine. Wheat, barley, oats and corn made up the principal grain exports. The meat was mutton and lamb. Potatoes, dry legumes, fresh vegetables, oranges and olive oil were the other leading exports.

The agricultural lands of North Africa lie between the Mediterranean and the northern Sahara desert. Most of it is rough, hilly and mountainous. It resembles in topography and climate much of central California. Included is timber land, farm land, and grazing land on which sheep and goats are the common stock. Oranges, grapes and olives are raised on the coastal lands. The grains are grown along the rivers and on the plateaus in the hilly areas.

Small, primitive farms and large up-to-date mechanized farms lie side by side. These large farms use machinery similar to that used in America, and it is from them that surplus crops may be expected if the necessary help is provided.

A food production program for French North Africa has been set up by the United States, Great Britain and local authorities, working together. The program, if successful, will produce enough food to feed all civilians and troops in the area, and perhaps supply Allied forces in southern Europe. It will save American food for Americans and the starving peoples in Nazi-conquered countries. Much shipping space will also be saved.

The associate director of the Office of War Information, Milton S. Eisenhower, has recently returned from a trip to these countries, where he studied the program and learned conditions at first hand. He was long associated with the U. S. Department of Agriculture. He sees no reason why French North Africa can not produce this year crops equal to those produced in pre-war days if the necessary assistance is given. He believes that in future years much larger crops can be produced by extending irrigation systems, bringing new lands into production and adopting better farming methods. French North

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Africa may become one of the larders for an impoverished Europe.

LEND-LEASE TO CHINA AND INDIA

LEND-LEASE is working both ways in equipping American, British and other Allied armed forces in India and China. The great natural resources of India are being converted into fighting equipment and accessories with machinery, instruments, drugs, chemicals and other essentials from America.

Textile machines sent from America are weaving cloth for uniforms, blankets and tents for Allied troops. American sawmills, shipped and reassembled, are cutting lumber for army uses. American-built locomotives are moving Indian products to army camps. A single boatload of sawmill machinery will manufacture as much material in a year as could be brought over the same route by the same boat in five years. Lend-lease with India is paying its way.

Lend-lease aid to India now amounts to some $300,000,000. Two thirds of this was for finished munitions, tanks and other vehicles. One third was for machinery and tools with which India will soon be producing finished products of the kinds shipped from America at the beginning of the program.

A considerable amount of American steel has been sent to India. But India is the second largest producer of iron ore in the British Empire. Machinery sent to India will greatly expand to present activities in steel manufacturing to meet all fighting and civilian needs. Manganese and molybdenum will still be sent, as no local supply is available, and without them India can not make steel.

India has 40,000 miles of railroad, a mileage exceeded only in the United States, Canada and Russia. But it is badly in need of rolling stock, particularly locomotives, and of wheels, boiler tubes, axles, and signal and telegraphic equipment. Much of these can be turned out in India if the needed machinery is supplied.

Approximately 400 textile mills in India, weaving textiles for the use of the Allied forces, are using native cotton and other fiber. This is lend-lease in reverse without a dollar of American money being paid for the finished product. Twenty projects for the manufacture of munitions have been started with machinery and supplies sent from this country. Soon most if not all the munitions needed by the Allied armies will be available without the thousands of miles of water transportation now necessary.

A recent report of an investigator of the Office of Lend-Lease Administration who visited India late in 1942 says that country can produce supplies for the entire Burma-China-India front if properly developed. It has the needed manpower and much of the raw material. It lacks machinery and skills. America and England are helping to supply both.

ITEMS

THE weather, abnormally cold two weeks ago, reacted to the opposite extreme last week, according to the seven-day survey of the U. S. Weather Bureau. Over most the country, temperatures have ranged well above normal from the season. Highest "plus departures" were in the region between the upper Mississippi and the Rockies, reaching 12 to 20 degrees Fahrenheit above normal. Despite high temperatures and continued fair weather, however, fields in the great interior valley are proving slow about drying out. For the most part, the soil is too wet for early farm work.

WINTER, which has just ended according to the weatherman's reckoning, was near average in temperatures in the eastern half of the country, somewhat warmer than average in the West, according to data compiled by the U. S. Weather Bureau. To be accurate, it was a little colder than average east of the Plains region, but only a little—two degrees Fahrenheit or less. Western temperatures averaged from four to six degrees above normal. The Weather Bureau notes a marked contrast to last winter, which was abnormally warm in the northeastern quarter of the country and relatively cold in the South. The past week's weather is another record of ups and downs, with warm weather succeeded by another cold wave, which wrought additional damage to the truck-growing regions in the South.

EXCELLENT clinical results in the treatment of empyema (a serious chest infection) have been achieved by a combination of the disinfectant azochloramid, and the synthetic wetting agent, sodium tetradecyl sulfate, was reported by Dr. Orville Wyss, of Wallace and Tiernan Products, at a meeting of the New York Bacteriologists' War Research Projects Group. Synthetic wetting agents or detergents are generally known to the layman as soap substitutes. Their effectiveness against bacteria, or germs, is due to their property of concentrating around the bacterial cells and bringing about a disturbance of the electric charge distribution on the cell wall. This disastrously upsets the vital chemical processes of the germs. The wetting, penetrating and pus-dispersing properties of these soap substitutes or synthetic detergents can be used in the treatment of infected wounds by combining them with antiseptics.

ELECTRIC power lines can be boosted more than two thirds in capacity by adding small steel boxes crammed with sheets of aluminum and paper, is indicated by experiments conducted by R. D. Evans, Westinghouse consulting transmission engineer. A miniature power system was set up to simulate the power demands of a typical community. The small steel boxes, called capacitors, were installed to increase current-carrying capacity and meters checked the results. From the experimental work, Mr. Evans estimates that a regular 250-mile power line of 175,000 watts would supply enough extra power to supply a city of 350,000 population if 7,200 of the capacitors were added, together with necessary generating equipment. About $3,300,000 would be saved as compared with the cost of the usual method of installing additional transmission wires. Several thousand tons of copper and steel would also be saved by this method.

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SCIENCE NEWS

Science Service, Washington, D. C.

CLIMATIC CONDITIONS IN NEW GUINEA

THE approach of spring in the northern hemisphere will have little effect on the importance of New Guinea in the Pacific warfare. New Guinea lies too close to the equator to have marked seasonal changes. It is summer there all the time. The extreme northern point of the island is just to the south of the equator, the southern extremity is only 12 degrees south of it.

The snow-capped mountains in New Guinea prevent the high temperatures that one might expect so near the center of the torrid zone. A high mountain range extends almost from end to end of the island. It has many high peaks, several over 15,000 feet in height, and two at least with glaciers. There are lower ranges to the north and south. The coastal regions are the hottest parts of the country. They are covered with dense tropical jungle. On the higher mountain slopes and plateaus the vegetation is more like that of Europe and America. Above the snow-line, at an elevation of 14,500 feet, little or no vegetation exists. Except on the low coast lands and on the high mountains the temperature ranges from 72 to 92 degrees Fahrenheit daily, with very little variation throughout the year.

New Guinea is the largest island in the world, if Australia and Greenland are regarded as continents. It is approximately 1,500 miles in length. In area it is nearly three times the size of the British Isles. It contains an area about equal to that part of the United States north of the Potomac and Ohio Rivers and east of the Mississippi, not including Michigan and Wisconsin. It is even larger than Texas—about 20 per cent. larger.

In outline New Guinea resembles somewhat a gigantic lizard, looking westward, with its head almost touching the equator. Its shoulders are slightly hunched in the direction of Japan. Its tail, the part called Papua, extends toward the southeast, ridging up into the Owen Stanley Mountains. Port Moresby is on the south side, Buna on the north.

It is a sparsely populated country, with about as many persons in the entire area as are now in the District of Columbia. The population is estimated to be less than a million, of whom only about 10,000 are Europeans. The rest are mostly natives. Among them are some of the most primitive people in the world.

Agriculture and mining are the principal industries. Coconuts, cacao and coffee are the largest agricultural exports. New Guinea furnishes a considerable portion of the world's supply of gold. Natives are employed in the gold fields.

From Cape York Peninsula, Australia, it is but a hundred miles across the shallow Torres strait to the southern coast of New Guinea, and about 300 miles northeasterly to Moresby. From Moresby to Buna is approximately 100 miles by air, but considerably more by the circuitous route over and through the Owen Stanley Mountains.

New Guinea is cut up into three political divisions. The western half belongs to the Netherlands. The two eastern divisions are under British control. The southern part of it is Papua. The northeastern part and the neighboring islands are under Australian mandate.

Papua has about 90,000 square miles of territory, with 2,500 Europeans and 275,000 natives. Mandated northeast New Guinea, together with the Bismarck and Solomon Islands, includes 70,000 square miles of mainland and 23,300 square miles additional on the islands. Its capital is Rabaul, on New Britain, at present occupied by the Japanese. Its population includes about 6,000 Caucasians and 500,000 natives.

THE PROBABLE SPREAD OF TROPICAL DISEASES

A WORLD-WIDE spread of tropical diseases can be expected after the war, was stated by Colonel Thomas T. Mackie, of the Army Medical College. He described the problem at the National Conference on Planning for War and Postwar Medical Services held in New York City March 15 under the auspices of the Carlos Finlay Institute of the Americas.

The present war, Colonel Mackie said, is unlike any in history in the enormous potential hazard of disease to which populations may and probably will be exposed. The peak of the hazard will come after the war as armies that have become reservoirs of disease return home and as masses of people in oppressed and disease-ridden countries emigrate.

Besides furnishing food and clothing to relieve malnutrition, semi-starvation and destitution, the United Nations will be faced with the "imperative need for the effective control and treatment of disease" in occupied nations. Public health practice and the practice of clinical medicine will be affected in many parts of the world by the expected extensive migration of tropical diseases.

Tropical diseases do not stay in the tropics because of the climate. Malaria can and does occur in such far northern regions as Canada and the British Isles. Even such a strictly tropical disease as filariasis, popularly known as elephantiasis, has existed near Charleston, S. C.

Sanitation and personal hygiene are more important than climate in keeping these diseases out of temperate regions. But they can spread wherever mosquitoes, ticks or other insects that carry the germs exist, and many kinds of insects capable of carrying tropical disease germs are widely prevalent all over the world. Other kinds, never before known to carry these germs, may acquire that ability. Constant air transport between widely separated theaters of war may accidentally spread widely both disease-infected persons and the mosquitoes or other carriers of the disease.

SUNFLOWER-SEED OIL

SUNFLOWER-SEED oil, which may be obtained in large quantities from certain varieties of the common sunflower, is a possibility in the United States to help to fill the shortage in edible oils due to war conditions.

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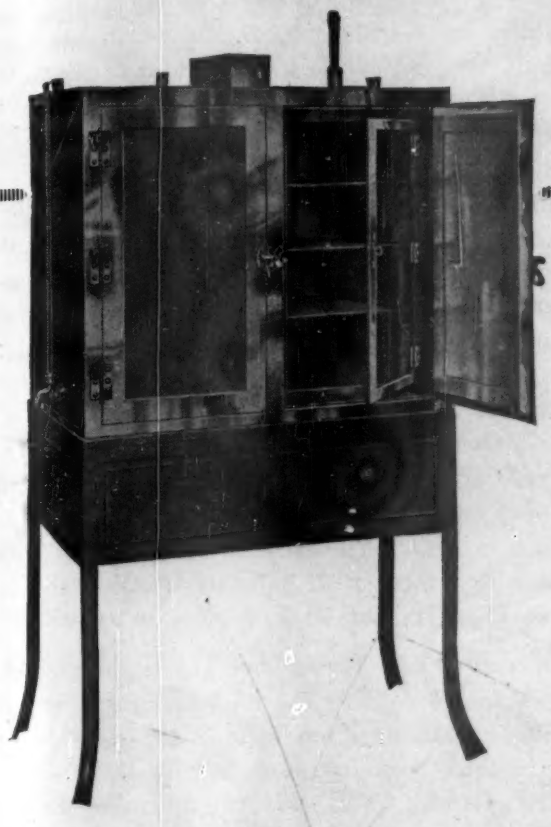

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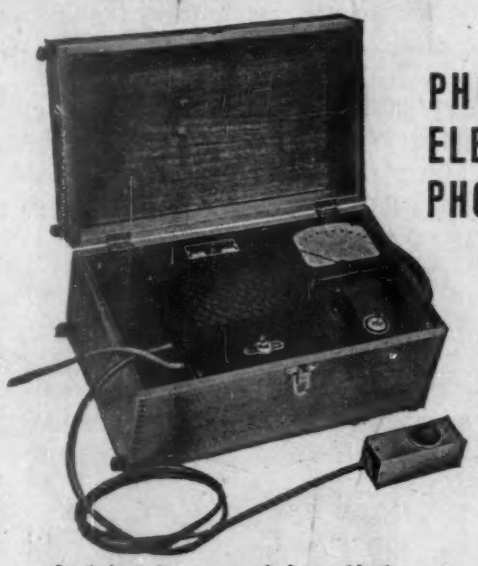

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Imported olive oil, which came from Spain, France, Italy and French North Africa in pre-war days, is now available only in small quantities. Peanut oil and cottonseed oil are demanded in great volume for war purposes. Russian sunflower-seed oil is no longer obtainable. Argentine oils are filling only part of the need. Sunflower-seed oil produced at home would save shipping, supply the demand and develop a new source of income for the American farmer in post-war times.

American sunflowers grow luxuriantly in much of the country. Much of the seed finds its way into commerce, but largely as bird and poultry feed. Missouri raises the largest commercial crop, even exceeding Kansas where the sunflower is the state flower. California is also raising the seed for market.

Oil from sunflower seed was produced commercially in the United States a generation or so ago on a relatively small scale. The industry was discontinued because of the high labor costs when compared to labor costs in the other countries producing edible oils.

Dr. G. S. Jamieson, of the U. S. Department of Agriculture, states that land suitable for corn is suitable for sunflowers. The crop can be planted and cultivated with the same implements. New mechanized methods of harvesting, threshing and processing will make it a profitable crop for oil as well as for poultry feed. Argentina is showing us the way this can be done. It is now producing large quantities of sunflower-seed oil and shipping much of it to the United States. In 1932 it produced only about 5,000 tons. The Spanish War cut off Argentina's supply of olive oil, and it started to raise its own table oils from peanuts, cottonseed, rapeseed and sunflower seed. Now the amount made from the sunflower far exceeds that from all other sources together. According to the U. S. Department of Commerce, it is nearly 500,000 tons a year, one fourth of which is being sent to this country.

POTASSIUM IN FERTILIZERS DETERMINED BY RADIOACTIVITY

RADIOACTIVITY is now being used to determine the amount of potassium in fertilizers and other mixtures. The new method may completely replace the old chemical analysis method, until now the only general method in use. This is a laborious task taking hours to complete. The radioactivity method requires but a relatively short time. It is claimed to be accurate.

Radioactivity is a property possessed by certain substances, such as radium, of giving off spontaneously special rays or radiations that are invisible to the eye but which will pass through materials through which ordinary light will not pass. Potassium mixtures and compounds possess this property to a slight degree. In the new method the quantity of potassium present is determined by the intensity of the radioactivity of the mixture. The radioactivity is weak, but is measurable by extremely sensitive modern physical instruments.

The new method is the result of work by Dr. R. Bowling Barnes and Dr. D. J. Salley, of the American Cyanamid Company. A report on it was published recently by the American Chemical Society.

In the new method an instrument known as the Geiger counter is used. It was developed to measure radioactivity. The sample of the mixture containing potassium is dissolved in water, with or without the assistance of an acid, and introduced into a special glass cell which surrounds the Geiger counter tube. The tiny impulses caused by the radioactive changes in the potassium atoms of the sample actuates the counting apparatus.

ITEMS

THE city of Washington, D. C., which has become a crossroads for most of the world as well as the forty-eight states, enjoyed the healthiest year in its history during the first year of the present war, 1942, according to Dr. George C. Ruhland, District of Columbia health officer. Dr. Ruhland reported that: The infant mortality rate, one of the best indices of health in a community, was the lowest of all time, 44.6 infant deaths per 1,000 live births. The latest available national infant mortality rate was 45.3 in 1941. Maternal deaths dropped to 2.2 per 1,000 live births, compared with a national rate of 3.2 in 1941. The death rate from all 10 major disease causes of death except diabetes decreased during 1942. The general death rate of 10.8 per 1,000 population is the lowest in the history of the District of Columbia, having dropped from 11.8 in 1941. The birth rate of 25.1 per 1,000 population, with a total of 21,317 new Washingtonians arriving since Pearl Harbor, is the highest in at least 50 years.

MENINGITIS cases throughout the nation in the week ending March 6 reached the highest figure for any week since 1927. This does not include any cases in Indiana, still unreported, but does include 25 delayed case reports from the previous week. For the first nine weeks of this year the total number of cases has reached about 3,500. This figure, recorded in less than one fourth of the year so far, is one third of the total reported in 1929, when a total of 10,551 cases with 4,781 deaths was reported. No figures on deaths from meningitis this year are as yet available, but it is believed the sulfa drugs are saving many lives in the present outbreak. The peak of this outbreak should come some time this month, meningitis being a winter and spring disease chiefly. Last year, however, the number of weekly cases continued at a high level throughout the summer and early fall. It is impossible to predict whether that will happen this year. The outbreak is concentrated chiefly in the states along the Atlantic and Pacific coasts.

NYLON sutures will be used by surgeons this year to sew war wounds, replacing Jap silk formerly used, E. I. du Pont de Nemours and Company have announced. Millions of feet of the plastic filament formerly produced for tennis racquets and fishing leaders are now being made for surgical sutures and large quantities are being shipped to the medical deposits of the United Nations throughout the world. Nylon filaments are solid strands, in contrast to braided silk sutures. It is claimed that germs from infected tissue are not absorbed and can not travel through the nylon as sometimes occurs in braided material. The synthetic is also inert, non-irritating and does not fray or splinter. Satisfactory results have been reported from England where nylon sutures have been widely used on the victims of bombing.

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By MARY STUART MacDOUGALL
Professor and Head of the Department of Biology, Agnes Scott College

In collaboration with

ROBERT HEGNER
Late Professor of Protozoology, and Head of the Department of Medical Zoology, The Johns Hopkins University

963 pages, 6 x 9, 555 illustrations. $4.00

IN this new book the authors have made a notable addition to those few elementary biology texts that truly deserve to be called distinctive. Keeping in mind the needs of beginning students and the preferences of instructors, Professors MacDougall and Hegner present an adroit combination of the principles and the types course, in an arrangement which allows an unusual degree of flexibility.

Critics who read the manuscript say that here is a text that really *explains* topics—not merely mentions them. The story of biology, simply told, is the aim throughout. Yet the scientific point of view has not been sacrificed and all subject matter found in any first-class course in general biology is included in this text.

Although emphasis is placed on zoology, plant biology is included in every general discussion of principles, respiration, excretion, reproduction, etc.

The balanced treatment is a feature of the book, and the practical applications of biology, interesting as they are, are not emphasized at the expense of the fundamentals of the study. Recent advances, however, are given more attention than usual, particularly in such fields as genetics and human biology and welfare.

There is a wealth of excellent illustrations, and an effort has been made to clarify all difficult points with diagrams and photographs.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES AT TURRIALBA

RUBBER, cinchona, tropical fruits and many other crops of importance to America in both war and peace are expected to benefit by research at the new Inter-American Institute of Agricultural Sciences at Turrialba, Costa Rica, which it was planned to dedicate on the occasion of Vice-president Henry A. Wallace's visit there, shortly after his arrival in the capital, San Jose, on March 18.

As Secretary of Agriculture, Mr. Wallace was greatly interested in the promotion of agriculture in the American tropics, as a means for providing the countries to the south with products which would supplement, rather than compete with, North American agriculture, and thus afford a substantial basis for the "good neighbor" program.

At Turrialba, the Costa Rican government has provided 1,200 acres of the finest upland soil to be found in the American tropics. Formal title was transferred to the institute late last month, although initial phases of actual field work had already been in progress for some time. This locality, at 2,000 feet above sea level, was chosen because less than two hours' ride by car or train can carry the investigator through an almost complete cross section of tropical American conditions.

Scientific work at the institute is to be entirely research on the post-graduate level; no undergraduate courses are contemplated. Facilities of research stations in other Latin-American countries have already been made available. Until the war is over, only temporary buildings will be erected. However, plans for the permanent plant are already drawn up, and construction can go forward rapidly once materials and manpower are released.

Research is already in progress on rubber, cinchona, foodstuffs and tropical hardwoods. Work will begin soon on plants providing oil, fibers and insecticides.

At a press conference immediately before taking off, Vice-president Wallace expressed great interest in the plant breeding program to be carried on there, especially in the breeding of rubber trees of higher productivity and greater resistance to disease. He expressed the opinion that "Plant breeders have been making, and can and will make, as rapid progress in increasing production of natural rubber as chemists can make in the production of synthetic rubber."

The director of the new institute is Dr. Earl N. Bressman, formerly with the Coordinator of Inter-American Affairs. The secretary is José L. Colom, of the Pan American Union.

From Costa Rica the Vice-president and his party will proceed to Panama, thence southward for visits in Chile, Bolivia, Peru, Ecuador and Colombia, returning to Washington late in April. As much time as possible will be spent in the field, obtaining first-hand information about agriculture, forestry and mining in the countries visited. At his press conference, Mr. Wallace expressed regret that time does not permit visits to all the South and Central American republics on the present trip, but he added that he hopes to see these countries in the not too distant future.

Accompanying the Vice-president are Laurence Duggan, of the Department of State, and Hector Lazo, of the Board of Economic Warfare. James Le Cron, of the Office of Inter-American Affairs, went with the party as far as Panama, returning to Washington from there.—FRANK THONE.

ADVANCES IN MEDICINE AND SURGERY

"THE remarkable advances in medicine and surgery since the first World War are now paying large dividends in saving the lives of soldiers wounded in combat," is pointed out by statisticians of the Metropolitan Life Insurance Company in the official bulletin. The sulfa drugs, blood plasma and new anesthetics are listed as outstanding discoveries contributing to reduction of war wound casualties.

Gross statistics, even where available, are of little value in measuring the achievements of our military physicians, it is pointed out, for two reasons:

1. Changes in military technology and the type of warfare, including greater use of tanks, planes and other mechanized equipment, and the creation of deadlier weapons and projectiles, such as heavy and incendiary bombs, are likely to cause more numerous and more severe wounds of fighting men to-day than in the last war.

2. Better organization of medical services in the field, on the other hand, probably will result in inclusion among the wounded of some men who, in previous wars, would have been recorded as killed in action because they died of their wounds before they were found.

The report states that "Despite all this, definite indications of improvement in wound fatality rates are available from scattered sources."

Preliminary data on our Army casualties up to December, 1942, show a fatality rate of about 4 per cent. compared with 7.7 per cent. in the first World War. In the Solomons fighting, deaths from abdominal wounds were less than 5 per cent., although the rate for mortality from this type of wound in previous wars has usually been higher than 50 per cent. The fatality rate from chest wounds, formerly running over 25 per cent., was reduced in one British medical unit to about one fifth of that figure among casualties evacuated from Dunkirk.

Wound infections and gas gangrene have been relatively infrequent, largely as a result of routine use of the sulfa drugs. Tetanus has been practically eliminated by the routine protection given our men by tetanus toxoid.

Shock and hemorrhage are being successfully fought by plasma transfusions of wounded men in the field. Sedative drugs promptly given in the field are also reducing the danger of shock. In many cases these measures have made it possible to defer major surgery until the wounded could be transported away from the fighting zone to base

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Material is presented in this text for a basic study of physics suitable for students of engineering in an intensified course. A large number of practical problems with answers are included. By J. E. Hoyt, Drexel Evening School, Philadelphia, Assisted by C. A. Bareuther. **179 Illus. 445 Pages. $2.50** (1940)

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THE BLAKISTON COMPANY, Philadelphia

hospitals where more adequate surgical and nursing care can be given. Air transport has aided greatly here. With its aid, many of those wounded in North Africa were being treated in the United States only a few days after being wounded.

The problem raised in this war by burns from incendiary bombs, high explosives, gasoline and oil fires has been largely solved and many lives saved by new methods of treating burns, including plasma and the sulfa drugs, developed in the years between the wars.

THE SHORTAGE OF PHYSICIANS

A PLAN for meeting the present shortage of physicians by having the special type temporary licenses to refugee physicians issued by the War Manpower Commission was suggested at the National Conference on War and Postwar Planning for Medical Services held in New York City under the auspices of the Carlos Finlay Institute of the Americas.

The suggestion was made on an unofficial and personal basis by Dr. Frederick P. Keppel, director of the Equitable Life Assurance Society of the United States, who is now in Washington serving on the War Relief Control Board and also on a two-man board of appeals on immigration visas for refugees.

The postwar practices of American doctors now serving their country with the armed forces would be safeguarded, according to Dr. Keppel's plan, by making these special licenses good only for the duration of the present emergency. The licenses, furthermore, would be limited to practice in certain localities such as the towns that have mushroomed around war industrial centers and army training camps.

Dr. Keppel pointed out that the American people are ignorant and uninformed on the immigration problem. They are still laboring under the impression that hordes of unwashed, illiterate people are clamoring at the gates. Actually, if every application for a visa were granted, the number would be only one tenth that allowed under pre-war immigration quotas. Only about one half of the number is approved, however, and of those approved, only about one half manage to get to this country.

The immigrants to-day are to a large extent people of culture. A large proportion is made up of professional people, such as doctors, dentists, nurses and research workers, in all of which categories we have a serious shortage. Dr. Keppel's suggestion for temporary, special type licenses for physicians was made with the hope of helping to solve the problem of how to use these refugees to the best advantage of the United States and still protect the jobs of those Americans away at war.

ITEMS

THE current meningitis outbreak appears to be approaching the proportions of the 1929 epidemic, which was the biggest meningitis outbreak on U. S. Public Health Service records. For the week ending March 13, the latest on which figures are available, 514 cases were reported throughout the nation, exclusive of Rhode Island, whose report has not yet been received. This state reported 19 cases the previous week. A similar figure from that state for the week just ended will bring the week's total up to or over the 531 cases for the preceding week, ending March 6. Through the week of March 6 a total of 3,515 cases of meningitis has been reported this year, a figure more than 25 per cent. above any other nine-week period in the past sixteen years. The total of 4,029 cases from January 1 through March 13 this year is higher than any other year since 1937 when 5,484 cases were reported during the entire year. When the present outbreak will be over is impossible to predict. In nine of the past sixteen years the peak of the meningitis season has come before the end of March. In five years it came in April and in two years as late as May.

SUCCESSFUL use of blood plasma to fight shock from fever treatment for gonorrhea is reported, apparently for the first time, by Lieut. Arthur M. Pruce, chief of the section of physical and fever therapy at Stark General Hospital, Charleston, S. C. The report appears in the *Journal* of the American Medical Association. Lieut. Pruce explains that he is reporting this use of plasma "because our armed forces have instituted a rapidly expanding program of fever therapy to treat venereal diseases" and shock is one of the more dangerous complications of this kind of treatment. Rise in the pulse rate and fall in blood pressure, indicating impending collapse, forced discontinuance of the fever treatment after about five and one half hours in the case Pruce reports. In spite of treatment with the usual anti-shock measures, the patient went into shock six hours after the fever treatment was discontinued. At this point about half a pint of blood plasma was injected into the patient's vein. Within 20 minutes the patient recovered from the shock condition. "Interestingly enough," Lieut. Pruce adds, "the patient was cured of gonorrhea in spite of only five and three quarters hours of therapeutic fever."

SEEDS have assumed an importance out of all proportion to their size, and crop prospects are debated daily in Congress. Means for making each seed more efficient, covered by newly-granted U. S. patent 2,313,057, therefore take front-rank position in the week's news of inventions, along with more conventional mechanical, chemical and military novelties. Patentee is Albert C. Fischer, of Chicago. The invention, briefly, is a simple method for making each seed carry into the soil a small provision of fertilizer, fungicide, insecticide and (in the case of legumes) nitrogen-fixing bacteria that it needs in its first day or so after germination. This is accomplished by coating the seed with a water-soluble glue into which the initial life-needs of the seedling-to-be are impregnated. To protect the seed against possible ill effects of too-long contact with fertilizer and fungicidal compounds, it is first covered with a coating of neutral glue, then with one or more coats containing the chemical and bacterial growth aids.

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SCIENCE NEWS

Science Service, Washington, D. C.

NEW SEISMOGRAPH FOR THE NATIONAL ASTROPHYSICAL OBSERVATORY OF MEXICO

EARTHQUAKES and sleeping volcanoes in Mexico will be studied intensively by one of the world's most sensitive seismographs, to be installed in Mexico's National Astrophysical Observatory through the cooperation of American scientific men with the State Government of Puebla, headed by Dr. Gonzales Bautista.

The Mexican Ambassador, Don Francisco Castillo Najera, in Washington, announced the acquisition of the instrument, and Dr. Harlow Shapley and Dr. L. Don Leet, of Harvard University, state that arrangements for the shipping and installation of a Benioff vertical-component seismograph, which has recently been thoroughly tested by Daniel Linehan, of Weston College, have been concluded by the Committee on Geophysical Research of Harvard University. The instrument was provided by the National Research Council in Washington and was originally intended for use in the studies of local earthquakes. Recent events in Mexico have shown that seismographs of this type, located where they will contribute new information about Mexican earthquakes, will contribute also to knowledge of volcanic activity.

The seismograph will soon be installed at Tonantzintla, just east of the famous towering twin mountains, Popocatepetl and Ixtaccihuatl.

This new seismograph is one of the latest models of a type that has proved itself to be among the world's best. It was developed by scientists at the California Institute of Technology. Some of the earliest investigations with Benioff seismographs were made at the Oak Ridge, Mass., station of Harvard University, resulting in the discovery of previously unsuspected minor seismic activity in this area. The great success of Harvard with this instrument has led to its widespread adoption in this country and abroad.

The seismograph produces a record of ground vibrations in the form of lines on photographic paper. It is capable of magnifying ground motions by as much as 250,000 times. At Oak Ridge it records the passing of trains eight miles away as well as earthquakes on the opposite side of the globe.

Mexico is one of the best natural laboratories available for a study of the related problems of earthquakes and volcanoes. There are both active and recently extinct volcanoes and numerous earthquakes. Some of these earthquakes, in fact all that are in the volcanic regions, are unusual in that they occur at distances of around sixty miles below the surface. Just enough information has been accumulated in recent years to cause investigators to be considerably puzzled and extremely curious about the connection between these earthquakes and the volcanoes. This curiosity was sharpened recently by the reported appearance in Mexico of a new volcano in a region where such earthquakes have been occurring over a period of years.

These investigations into the relationship of volcanoes and earthquakes mark an interesting cycle in seismological thought. The earliest theories of the origin of earthquakes held that all earthquakes were caused by volcanoes. Subsequent opinions, based on new facts, held that all earthquakes were caused by crust-distorting forces, and that any relationship to volcanoes is purely coincidental. It now appears that the forces which produce earthquakes in certain areas may also cause volcanic eruptions.

The installation of a high-sensitivity instrument in Puebla will provide an ideal opportunity, one of the few in the world, to study the day-by-day minor manifestations of the forces causing earthquakes and volcanic eruption, contributing perhaps ultimately to the solution of the larger problem of the origin of mountains.

THE SPEED OF CHEMICAL REACTIONS

How the methods by which a chemist determines the speed of a chemical reaction can be effectively used in the fields of physics and biology was described by Dr. Henry Eyring, professor of chemistry at Princeton University, at the University of Louisiana in a lecture which is also to be delivered before local chapters of the honor society of Sigma Xi throughout the country.

Dr. Eyring has developed improved formulas for predicting reaction rates by use of thermodynamics, statistical mechanics and the quantum theory. These formulas can be applied, he pointed out, to such apparently unrelated subjects as the flow of fluids, the velocity of sound and of nerve impulses, the light of luminous bacteria, the action of drugs and of enzymes. They bring a new and illuminating method of investigation into these fields.

The flow of fluids can be pictured as arising from individual molecules jumping from one equilibrium position to an adjacent empty one, just as in a chemical reaction the molecules jump from one position of equilibrium to another one, forming a new compound. The formulas for reaction rate successfully predict the velocity of flow of a liquid. When a liquid is compressed, some of the holes are squeezed out of it. The flow becomes more difficult. The liquid becomes thick—viscous. The picture thus explains this well-known fact.

When a sound wave travels in air, it must be passed on from molecule to molecule. Its speed is the average speed of the heat motion of the molecules. In water, the heat motion of the molecules is the same, but they are closer together. They bump each other more often, so that the sound impulse is passed along about eight times as rapidly as in air.

A nerve impulse travels about one fifteenth as fast as sound travels in water. This is interpreted by Dr. Eyring as meaning that each molecule must make about fifteen tries to get the message over to the next molecule. The light emitted by luminescent bacteria is due to the catalytic action of an enzyme. The catalyzing molecule, after bringing about the oxidation of the luciferin molecule, finds itself in an excited state and emits a quantum of

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blue light. Temperature and pressure affect the intensity of the light in the same way they affect chemical reaction rates. Sulfanilamide reduces the light intensity and so does urethane. But the two together reduce the light less than does sulfanilamide alone, indicating that these two drugs are antagonistic and form a combination.

From these studies of luminescence, Dr. Eyring expects a more detailed understanding of the action of drugs and of biological enzymes in general.

VITAMINS

VITAMIN or other dietary means of preventing and curing now uncontrollable diseases, as we now control scurvy, pellagra and rickets, was predicted for the future in a Sigma Xi lecture at Purdue University by Professor C. A. Elvehjem, of the University of Wisconsin.

Recent studies in his own and other research laboratories of the twelve or more B vitamins furnish the basis for Professor Elvehjem's forecast for the future of nutritional research.

Lack of one of the newest B vitamins, folic acid, may be the cause of a blood disorder, a sort of white blood cell anemia, that develops occasionally in patients getting sulfa drug treatment and also sometimes without such treatment. The same condition develops in rats following treatment with certain sulfa drugs, and it also develops in monkeys deprived of the vitamin. The reason the rats get the condition seems to be that the sulfa drugs stop the growth of microorganisms in the rat intestinal tract which normally manufacture some of the B vitamins.

In both monkeys and rats the white blood cell anemia, though induced by diet in the one case and by sulfa drugs in the other, can be prevented by folic acid. The condition may develop following twenty days of sulfa drug treatment because the patients had been on short rations of folic acid and could not stand further depletion by the drug of their reserve supply of this vitamin. "We can only speculate as to the importance of the other factors in human nutrition," Professor Elvehjem concluded, "but I am willing to wager that equally important relationships will develop. As research continues we may learn from it nutritional means of handling diseases which are uncontrollable today as readily as we now control scurvy, rickets and pellagra."

Biotin, inositol and p-aminobenzoic acid are other new B vitamins which the latest studies show may have significance in human nutrition, besides those with which biochemists, nutritionists and even lay persons are now familiar: thiamin, riboflavin, niacin, pantothenic acid, pyridoxine and choline. Two chemically unknown factors needed by the chick for growth and feather production and one or more factors of significance in guinea pig nutrition complete the tally of now known B vitamins.

ITEMS

QUININE content of newly discovered cinchona stands can now be analyzed on the spot by a new portable device instead of sending bark samples to remote laboratories. The first four units have been shipped to South America to speed development of quinine sources and for inaugural tests under field conditions. Knowing that quinine fluoresces or glows under ultraviolet light, Martin S. Ulan, of Rutgers University, consultant to the BEW Office of Imports, went to work with his associates to develop a machine that would make laboratory testing of cinchona bark unnecessary. Starting with an instrument used to test fluorescent minerals, the galvanometer was dispensed with and a set of tubes each containing a different strength of quinine solution substituted; each with a different degree of fluorescence. By comparing these with an unknown sample the quinine content can be calculated. This test, conducted in a few minutes in the heart of the jungle, is expected to be nearly as accurate as more complicated laboratory procedures. Simple instructions included with the new device can be followed by a layman without technical training.

"STRIKING clinical improvement" in nine out of ten patients suffering with "shipyard eye" has been achieved by injections into the veins of blood serum from other patients already recovering from the eye condition, is reported by Dr. Alson E. Braley and Dr. Murray Sanders, of New York, in the *Journal* of the American Medical Association. The group of cases treated is small and further studies with control cases are needed before convalescent serum can be accepted as a cure for the condition. However, since this ailment is occurring in epidemics in industrial areas in many parts of the country, and since no other treatment has materially shortened the course of the disease, it is felt that attention should be called to the possibilities of convalescent serum treatment. Seven of the ten patients were "clinically cured," six of them in forty-eight hours. In two others the normal course of the disease was shortened and corneal changes possibly aborted. One case is classed as a failure because adequate information following treatment could not be obtained.

PLASTIC lithographic printing plates, made from polyvinyl alcohol resin, are reported to be in use in the Army for printing colored maps and other military documents, and in mobile field printing units. Their use saves from three to eight times their weight in critical aluminum and zinc. The development came about through the use of polyvinyl alcohol as a coating on zinc to improve the printing quality of the metal. It became apparent that the actual printing was from the plastic and not the metal, and that other material could as well be used for the base as zinc and aluminum. In the new plate the base is paper impregnated with the polyvinyl alcohol resin which gives it the required strength and stability. It is waterproofed with a coating of another resin. Two sheets are then laminated to form the base, and the printing surface coated with the polyvinyl alcohol resin. Creation of the printing image is the same as with metal. The resin plastic is sensitized with bichromate of ammonia. It is exposed to light, treated with the developing ink, developed in water and etched, and is then ready for use in the press. The development of this plastic for lithograph printing plates was carried out in the laboratories of the du Pont Company, and the plates are made by a Boston company. The Army at present has preempted the entire output, but it is expected will be available at a later date to the printing trade.

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SCIENCE NEWS

Science Service, Washington, D. C.

THOMAS JEFFERSON

CONJURE up in your mind's eye five images of Thomas Jefferson, whose birth on April 13, 1743, two hundred years ago, is being celebrated this year. Stand them side by side. In the center is Jefferson the lawyer, statesman and public servant. To the right is Jefferson the music-lover, violinist and singer, and Jefferson, the horseman and lover of outdoor sports. To the left stands the scientist and inventor, and also the landowner and farmer.

These five Jeffersons together constitute the man whom history records as one of the most versatile persons in America's early days. His music and his horsemanship were his recreation. His inventions were his hobby. His "tranquil pursuit of science" was, to use his own words, his "supreme delight." He inherited nearly 2,000 acres of land and added another 3,000 by purchase. His father-in-law left him a 5,000-acre plantation to manage as an additional farming activity.

As a scientist Jefferson was interested in many branches: geography, geology, botany, zoology, medicine, agriculture, chemistry and the natural sciences. The practical side of all these appealed to him. He once wrote, "I have wished to see chemistry applied to domestic objects, to malting, brewing, making cider, bread, butter, cheese, soap, and the incubation of eggs."

Although the subject had not yet been named, Jefferson was a great early paleontologist. The fossil remains and the bones of prehistoric animals delighted him. He secured a number of the bones of an animal about the size of a bull moose found in a cave in Virginia. Because they included a large claw he called the animal the "big-claw" or Megalonyx. The bones were sent to Philadelphia and the animal "reconstructed." They are still there with the Academy of Natural Sciences. The animal was a giant ground sloth, extinct for some 30,000 years.

Jefferson collected many prehistoric bones through friends in Ohio, Kentucky and elsewhere. His great interest in paleontology was awakened by his contacts in Paris with leading scientists; in the days when Jefferson represented the United States Government there, Paris was the center of the sciences, particularly botany and zoology.

Thomas Jefferson, while president and at other times, seems to have had a keen sense of the important part science would play in the future of the American nation. His foresight is responsible for much of the scientific work done by the Government then and later. He is credited with being the originator of the patent system. The idea of a National Bureau of Standards is in a report by him to Congress in 1790. The report suggests plans for establishing uniformity in the coinage and weights and measures of the United States.

In 1806 President Jefferson recommended a coast survey, on which the Congress took favorable action in February 1807. The continuation of this survey work is carried on by the Coast and Geodetic Survey. Other recommendations had much to do with the establishment later of the Naval Observatory, the Hydrographic Office and the Weather Bureau.

Further evidence of Jefferson's great interest in the sciences is shown by two exploratory trips which he made possible. He sent Colonel Zebulon Pike to explore the peak that now bears Pike's name. He asked the Congress to authorize the expedition of Lewis and Clark. He paid from personal funds $2,500 to help finance the trip. The report of these two men, made from their notes written daily while traveling up the Missouri River and crossing to the Pacific, is filled with scientific observations resulting from instructions received by them from the President.

Jefferson as an inventor never took out a patent. In a large measure he is responsible for the creation of the U. S. Patent law and he was the first administrator of the law. Under it patents were issued by a board composed of the Secretary of State, the Secretary of War and the Attorney General. He was Secretary of State and chairman of the board. The work in connection with patenting was carried out in the State Department and the books and records kept there. Jefferson and his contemporary inventor, Benjamin Franklin, both decided to contribute their inventive genius to their country and to their fellowmen as they contributed their abilities in affairs of state.

Scientific principles were the basis of many of Jefferson's inventions. The moulding board of a common plow may not seem to be scientific, but it is. Jefferson sought a proper shape to turn the soil with the least effort, to break the soil properly, aerate it, and to cover the turned-in vegetation to add humus to the land. It was certainly regarded as a scientific achievement by several French scientific societies which awarded him honors for his invention.

His pedometer sounds more scientific. With it a distance could be measured roughly by walking it. A recording instrument was carried in the watch pocket. A tape led from the instrument through a hole in the bottom of the pocket, down "between the breeches and drawers" to a knee band. This recorded every step taken, by one leg at least.

Jefferson's "whirligig" chair may not be a scientific device, but it was an important invention. It is the great-great-grandfather of all the swivel chairs for which Washington is famous and without which perhaps modern governments could not exist. A combination walking-stick and outdoor seat did not prove as prolific. His hemp machine for breaking and beating hemp into fiber is one of his greatest inventions.

Architecture is a science. Jefferson's great work as an architect was the designing of the original buildings of the University of Virginia, still standing and in use. It is his greatest memorial. Monticello, his home, is also his work. American people are familiar with its outline, as it is now on one face of the new Jefferson five-cent piece.

SEARCH FOR AN ANTIMALARIA CHEMICAL

A GREAT push to find a chemical remedy for malaria "which will not have the deficiencies of quinine, plasmochin and atabrine" is going forward, was reported by Colonel Paul F. Russell, of the Medical Department of

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the U. S. Army in the Herman M. Biggs Memorial Lecture at the New York Academy of Medicine.

"The need is apparent," he said, "when it is recalled that not one of this trio will cure with certainty, not one is a true prophylactic drug, and not one is of much value in the control of community malaria. It seems reasonable to hope that a more effective antimalarial will be developed in the not too distant future."

He pointed out that notable progress in controlling malaria even in tropical villages has been achieved with pyrethrum spraying. Experiments in rural South India in 1942 proved that the chain of malaria infection can be broken by this method in typical small villages at a per capita cost of about five cents a year, which is economically feasible even in India. The method consists in weekly spraying of huts, cowsheds and outbuildings where the malaria-carrying mosquitoes tend to remain.

Colonel Russell stated later that malaria kills at least 3,000,000 persons throughout the world each year and there are at least 300,000,000 cases of malarial fever. In such areas as Burma, New Guinea and the Solomons, malaria is by all odds the greatest disease hazard to our troops and is in some places a greater menace than the enemy. He continued, "it seems incredible that malaria still can be so great a scourge, for it is a preventable disease regarding which we possess as complete knowledge as for any human malady. There have been devised potent weapons for treatment and control. But malaria persists, of all diseases to-day probably the most effective barrier to prosperity, contentment and health. What a paradox! Man, with his incredible machines and his streamlined science, stricken each year in millions because he fails to outwit a mosquito carrying Death in its spittle!"

RADIO-QUALITY QUARTZ CRYSTALS

NUMBER ONE strategical mineral problem at present is a domestic source of supply of quartz crystals suitable for radio equipment and other electrical uses in the war effort. Radio is the life line of the armed forces. Battle movements of soldiers, sailors and airforces depend upon it. Dependable instruments in which crystals are used must have crystals of the finest quality.

Brazil and other South American countries are the sources of the present supply. In the United States there are plenty of quartz crystal deposits, but satisfactory crystals for electrical uses had not been developed from them in pre-war days. An intensive search is now being made by the U. S. Geological Survey, the Bureau of Mines and other agencies, to locate quartz crystals with the necessary properties. Results of the search are promising, although specific information will not be released until after the war. The best prospects appear to be in the crystals found in North Carolina, Virginia, Arkansas and California. The western mountain states are being searched as well.

Not all quartz crystals, regardless of their general resemblance, are usable in electrical work. They must be first cut, and then carefully tested in well-equipped laboratories for their electrical properties. Size and appearance are, however, important factors. To be usable they should be at least an inch in diameter and over two inches long. They should be clear, and free from fractures and discolorizations.

Quartz crystals are used in microphones, and as electric filters and oscillators. The so-called piezo-electric quartz crystal vibrates as an electric charge on its surface oscillates. The constancy of the rate of vibration is remarkable. It is more constant than the pendulum on a high-grade astronomical clock. A crystal of good quality kept at a constant temperature will not vary two seconds in ten days. It is this reliability that makes it essential as an electric oscillator.

ITEMS

FOOD crops for production in 1943 are more important at the present moment than guayule plantings for rubber in 1945. Since the recommendations of the Baruch committee were issued urging a greatly increased guayule raising program, the situation has changed. "The need for the maximum food production has become more pressing, and the outlook for synthetic rubber has become somewhat clearer," is emphasized by Secretary of Agriculture Wickard and Rubber Director Jeffers. Both feel that it is not desirable to use any large quantity of land for planting the rubber plant this year as the first rubber yield would not be until two years from now. Not only is the land needed for food crops but the manpower is needed also. The Department of Agriculture is planning to have plenty of guayule planting stock available in the nurseries in case a further survey shows by mid-summer that emphasis should shift again to rubber production.

"THERMOPLASTICS, like their thermosetting cousins, perform many necessary functions in electrical equipment, and the technical apparatus of the electronic world of the future will be served both by the material with which we are familiar, and by newer and better ones," according to H. K. Nason of the Monsanto Chemical Company who spoke at the Pittsfield, Mass., meeting of the American Institute of Electrical Engineers. These plastics are now serving many useful purposes in electronics, he continued, but much work is being done in industrial and other laboratories to develop a thermoplastic that will meet the full needs in the electronics field. This requires material which can be used in situations where high temperatures are encountered, and plastics that will not "creep," better known as cold-flow. The progress being made will not be reported upon until after the war.

VICTORY gardeners who have heavy clay soil to contend with may be able to improve its texture by the addition of sifted anthracite coal ashes and at the same time dispose of the ashes. Coal ash, it is pointed out, improves only the physical state of the soil; it is not a fertilizer. And only anthracite ashes are safe to use. Clay soils are sticky when wet, and hard when dry. Coal ashes will decrease the stickiness and help prevent the hardness. The amount to use depends upon the soil, but ordinarily two inches of ashes plowed or spaded into six inches of the topsoil is sufficient. The ashes and soil should be well mixed. Vegetables, flowers and grasses will grow better in soil so treated and the labor of taking care of the garden is lessened. Sandy soils are also improved by anthracite ashes. Their moisture retention properties are increased. In this the ashes have an effect similar to that of human.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE AMERICAN CHEMICAL SOCIETY

THE general staff of one of the most important divisions of American scientific and industrial war effort, gathered in Detroit on April 12 for the annual spring meeting of the American Chemical Society. For five days they will discuss accomplishments up to now, and plan future campaigns.

Rubber, high-octane gasoline, steel and the light metals, new anti-malarial drugs, foods and their vitamins—these and other equally war-significant subjects are up for discussion. A great many of the newer discoveries in chemistry, as in other sciences, are not to be discussed publicly; but there are plenty of nonconfidential facts and data to make a very full week's business for the several thousand members of the society who will be there. There are so many papers to be presented—some 325 altogether—that it was necessary to divide the meeting into 15 section to permit them all to be heard and discussed.

Honors for long campaigning and medals for distinguished service will not be lacking. A feature of the Wednesday afternoon general session will be the presentation to 14 veteran chemists of special diplomas certifying 50 years of continuous membership in the society. At the same session the Borden Award in the chemistry of milk will be presented to Dr. Earle O. Whittier, of the Bureau of Dairy Industry, U. S. Department of Agriculture. Professor Herbert E. Carter, of the University of Illinois, will receive the Eli Lilly Award in biochemistry.

Spoils of war will be on display—a great array of chemical patents owned in enemy countries, which have been seized by the Alien Property Custodian and are now available for use by American industry on the payment of a nominal fee. The custodian has guaranteed protection to any American user, against possible legal action by their present owners after peace has been concluded. There seems to be especial interest at the present time in patents on drugs and textiles. The intense preoccupation with dyestuffs, that marked chemical thinking in World War I days, is notably lacking now: in the quarter-century between the two wars America achieved chemical independence in that field.

A NEW SYNTHETIC RUBBER

THE development of a new kind of synthetic rubber which will help meet essential war needs has been announced by the Bell Telephone Laboratories. This new material, christened "Paracon," looks and feels like ordinary rubber, has a high resistance to damage by oil or gasoline, and is superior to natural rubber in resistance to heat, light and oxidation. It is inferior to natural rubber in resistance to steam, alkalis and acids.

In the raw state, Paracon is unusually adapted to moulding into intricate shapes. It is useful not only as a replacement for rubber, but in particular as for material for special application where its combination of unique properties is required. The aircraft industry is an example.

Paracon can be derived from agricultural products and coal products, or from coal and petroleum sources. It can therefore add to the present supply of rubber substitutes without interfering with the production of those already under way.

Synthesis of Paracon was accomplished by Dr. C. S. Fuller and Dr. B. S. Biggs and their associates in the Bell Telephone Laboratories. Several months ago, after Paracon had been demonstrated practicable at the laboratories, information was made available to the Baruch Rubber Committee and the War Production Board. Details as to the process involved were turned over to several chemical manufacturing companies to enable quantity production, and the Resinous Products and Chemical Company is now producing Paracon.

AIR PLANE TESTING TUNNEL AT WRIGHT'S FIELD

MANUFACTURED gales with velocities up to 600 miles an hour and controlled temperatures down to 67 degrees below zero Fahrenheit are expected in a new aircraft testing tunnel to be built soon at Wright Field. The giant air conditioning plant is being asesmbled under the direction of J. G. Bergdoll Jr., chief engineer of the York Ice Machinery Corporation. It will produce four million cubic feet of refrigerated air a minute. A man in ordinary winter clothing could survive only a few minutes if he were placed directly in the path of the refrigerated air stream. Even if his body could withstand the 600-mile force of the gale, he would be frozen stiff in a few minutes.

The tunnel will be shaped like the letter "O" and will be 600 feet long. The gale will be made by a 40,000 horsepower motor. The rapidly moving air will pass through cooling coils in which are circulated tons of a calcium chloride solution chilled to 40 degrees below zero by two giant refrigeration machines. These cool the air to seven degrees below zero.

Mr. Bergdoll stated that in making a stratosphere test, models will be placed in a steel compartment in the throat of the tunnel, an airtight door closed, and air pumped out, lowering the pressure to stimulate atmospheric conditions at various altitudes. It will be lowered from the normal sea level pressure of 14.7 pounds per square inch to less than 2.7 pounds, to simulate pressures found at altitudes of above 40,000 feet. In the new wind tunnel, temperature of the air stream drops naturally from seven degrees below to 67 degrees below zero as the tunnel narrows down from its widest part in the center to the smallest opening at the throat. This narrowing has the effect of transforming static into velocity pressure. It actually lowers the pressure while the speed of the gale is increased, resulting in a terrific temperature drop without the need for additional refrigeration equipment.

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HIGH-SPEED METHOD OF SAWING HARD AIRCRAFT METALS

AIRCRAFT metals are being sawed at extremely high speeds by a new method was announced by Arthur A. Schwartz, of the Bell Aircraft Corporation, at the Milwaukee meeting of the American Society of Tool Engineers.

Engineers started with a wood saw on which the blade travels 12,000 feet per minute. After making some carbon steel blades, they experimented with such factors as temper and set of the teeth. Results were surprising. "We cut non-ferrous materials and ferrous materials," Mr. Schwartz said, "soft steels and very hard steels, in fact, the harder the steel, the easier it cuts."

Two half-inch pieces of armor plate are sawed by the new device at one time. Heat generated by friction of the saw teeth is so intense that the metal is melted and most of it turns into gas.

Eighteen such saws are now in use at Bell Aircraft for such operations as trimming of aircraft metals, and making boiled plate dies.

Mr. Schwartz also suggested that cutters, used to mill aircraft metals, can be made faster, cheaper and better. He stated that six out of seven teeth on the large multi-bladed milling cutter commonly in use should be removed. Only four teeth are needed. With each taking a healthy bite, faster production and smoother finish results. This simplified machine also removes the old problem of not having enough power. Pounds of critical high-speed steel are saved; cost and time are saved; and the cutter lasts longer at faster speeds.

To further conserve high-speed steels and carbides and speed production, Mr. Schwartz recommended that engineers use a wider selection of cutting materials for metal working. Cast alloys have not been used as much as they should, he asserted. Tantung, one of the alloys, is now giving better results in certain phases of aircraft production than the usual highspeed steel or carbide.

ITEMS

MAGNESIUM in major quantities, can be obtained from an immense deposit of dolomite near Las Vegas, Nev., in the Boulder Dam area, according to the U. S. Bureau of Mines. It has developed a process for converting the dolomite (a magnesium-containing limestone) into magnesia, and also an electrolytic method for extracting the pure magnesium from the latter compound. Sufficient engineering data are already in hand to justify the erection of a small commercial-scale plant to process the dolomite and thus pave the way for full development of the great beds by private industry. One privately owned plant already operating in the vicinity is using magnesite that has been hauled more than 1,000 miles by a roundabout route from another dolomite deposit in Nevada, and it is believed that the expense of delays thus involved might be obviated through the development of magnesite-producing establishments at the Las Vegas site, where available dolomite amounts to an estimated 400,000,000 tons.

WARM yellow radiance is given off by a new fluorescent material which possesses the power of absorbing invisible ultraviolet rays and transforming them into visible light. It is expected to have wide application in the future lighting of homes, stores, factories and theatres. The yellow glow is more agreeable to many persons than the harder, bluish-white light produced by most present fluorescent lamps. "The new material not only produces a light of a radically new color, but it also retains, unlike previous fluorescents, the power to emit light even if the materials contain impurities in the form of iron or nickel." The announcement was made by the American Optical Company, in whose laboratory the new discovery was made by Dr. W. A. Weyl, a member of the research staff and professor of glass technology at Pennsylvania State College. The substance glows without the addition to its composition of an activating agent like manganese, a necessary element in present fluorescents." Zinc oxide and vanadium pentoxide, combined by a controlled low-temperature heating process, are used in the new fluorescent substance. The material may be made more economically and easily in comparison with those previously discovered. It is still a laboratory development and not yet available to the public.

A BETTER vaccine for protection against typhoid fever may result from research at the Biochemical Research Foundation of the Franklin Institute, reported by Dr. Ellice McDonald, director, in his annual report of the Foundation's activities. Using chemical and physical methods to split the typhoid fever germ into many portions, the scientists obtained some starch-containing fractions of typhoid fever germs which were non-poisonous to mice. These fractions are believed to be the outer covering of the typhoid germs which normally serve to protect the germs against the white blood cells of the body's defenses. The outer covering of the germ also contains the substance, called antigen, against which the body develops specific defense mechanisms called antibodies. Isolation of a non-poisonous, antigenic substance from the germs may mean that this substance can be used as a vaccine against typhoid fever, instead of the whole germ.

JAPAN has one of the richest sources of high-grade toluene, raw material for TNT, in the oil from the great fields in Borneo, is stated by B. Orchard Lisle in the new issue of *Army Ordnance*. Mr. Lisle was formerly an editor of technical oil journals, and is now with the U. S. Army Air Forces. Bornean crude oil is exceptionally high in toluene content, he states, and extraction with equipment now operating in Japan is easy. It is probable that the Japanese are already using at least some of the oil from Borneo, for the wells there are relatively shallow and easily re-drilled; and it is not certain that during the first rush of the Jap invasion they were thoroughly demolished. The foresighted enemy planners also had oil-field experts openly in training for the conquest which they as openly stated they intended to undertake.

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SCIENCE NEWS

Science Service, Washington, D. C.

GOLD DISCOVERED IN THE SUN

DR. CHARLOTTE E. MOORE, of Princeton University Observatory, and Dr. Arthur S. King, of Mt. Wilson Astrophysical Laboratory, reported at a meeting of the Astronomical Society of the Pacific that evidence of gold in the sun has been obtained for the first time. The discovery of gold makes a total of 66 elements positively or tentatively identified in the sun out of the 90 found so far upon the earth. The evidence depends chiefly upon the fact that one of the strongest radiations or spectrum lines emitted by gold in the form of a glowing vapor agrees closely in position with a weak unidentified line in the spectrum of the sun.

It was already known that gold is so scarce in the sun that only the strongest lines observed in the laboratory would be likely to appear as very weak lines in the solar spectrum. Unfortunately, the strongest gold line of all —its so-called ultimate line—is hidden from view in the solar spectrum by the powerful ozone absorption bands of the earth's upper atmosphere. So little was known about the remaining strong lines of gold that occur in the observable parts of the solar spectrum that it was useless to attempt their identification.

The situation until two years ago was somewhat similar to that of a miner who has a map showing the location of several dozen veins of gold within a huge mountain side, all of which are very thin with one exception. He would like to bore for this single rich vein, but he does not know which one it is.

However, when the results of an investigation of the sensitiveness of lines in the gold spectrum became available in 1941, the search for gold in the observable region of the sun's spectrum could proceed with more certainty. It would be highly appropriate if the critical line upon which the identification depends occurred in the yellow-orange part of the spectrum. Actually it is in the ultraviolet, invisible to the eye but readily observable by photography.

One possible source of error remained that might invalidate the entire proceedings. The position of the solar line was obtained from a catalogue of the solar spectrum compiled over half a century ago by the famous physicist, H. A. Rowland, of the Johns Hopkins University. Some of the weakest lines listed by Rowland do not appear on modern plates, although the same plates may show other weak lines not observed by him. This is particularly true near the ultraviolet limit of the solar spectrum. In addition, this line of gold is what is known as a "low temperature line" or one that is strong in comparatively low temperature sources of light. Therefore, it should appear stronger in sunspots, where the temperature is about 8,000 degrees Fahrenheit, than in the surrounding surface of the sun at a temperature of 11,000 degrees Fahrenheit.

To check on these points, Harold D. Babcock and Mrs. Mary F. Coffeen, of the Mt. Wilson Observatory, made an examination of photographs of the sunspot spectrum taken during the course of a previous investigation. Not only did they find a weak solar line at the proper position but it was also seen to be moderately strengthened in the spot as would be expected of a low temperature line. They concluded that, "This moderate strengthening in the spot together with the satisfactory correspondence in position of the solar and laboratory lines, would seem to justify the statement that gold is now identified in the sun."—ROBERT S. RICHARDSON.

THE SCARCITY OF SCIENTIFIC APPARATUS

SCIENTIFIC laboratory apparatus is on the list of scarce articles; that is, unless the laboratory needing the apparatus is doing war work. Equipment for physics will be particularly short because the 240,000 servicemen now being sent to 450 colleges and universities will all be required to take courses in physics.

The Army and Navy need hundreds of thousands of physicists and men with a knowledge of the fundamentals of physics. War is technical. Fighting, transportation and communication articles of equipment are all technical also. Most of them are based on the principles of physics. They were developed and constructed by physicists and engineers. In the military service they are used by servicemen, and they must be kept in repair by servicemen.

The institutions where these servicemen are now being trained will need large quantities of new apparatus. Much of their old equipment does not fit into the exact courses the armed services require. They will need also instruments of the exact types the services are using so that the trainees will be familiar with the appliances they will use in the field.

The scientific instrument manufacturers will meet the needs as far as possible. Their capacities to produce the required apparatus at this time are somewhat limited. Long ago many of them converted part or even all of their facilities to war work, constructing physical apparatus needed in the war industries and in the armed services. They will be able to produce what is needed in the college training courses for men in the service, but probably very little if any for civilian laboratories not in war work.

Restrictions placed on the purchase of laboratory apparatus nearly a year ago by the War Production Board to save critical material and permit the factories to concentrate on war needs, have now been amended. Laboratory apparatus for the college military training programs now falls into the category of purchase orders for which applications must be made to the War Production Board, irrespective of the value of the items desired. This procedure is intended to control the distribution of the available equipment so that the war needs will be served first.

The needs of pre-induction courses in high schools will probably not be overlooked. These courses for young men who will reach induction age soon are given by the schools at the request of the Army.

Laboratories working on radio programs for the Army or Navy hereafter will be able to get from a central agency the supply of critical electronic components not quickly available in commercial channels. This agency is

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

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the Electronic Research Supply Agency, formed under the Defense Supplies Corporation at the request of the armed services, the Office of Scientific Research and Development and the War Production Board.

Active operation of the Electronic Research Supply Agency will begin about May 1 under an executive committee representing the government divisions concerned. Its office and stockroom will be located in New York City. As a central source of electronic parts, it expects to save laboratories the necessity of building up their own complete stockpiles of components. Laboratories, however, will not be compelled to use this central agency. It is merely for their convenience.

FIRST AID TREATMENT OF SHOCK IN SEVERE BURNS

A DRINK of salt water, of just the right strength, may become the future first aid treatment for shock in extensive burns.

Experiments at the National Institute of Health by Dr. Sanford M. Rosenthal, principal pharmacologist of the U. S. Public Health Service, point that way, although so far no human trials of the method have been made.

Survival rate for the first two days among burned mice given about one fourth of a teaspoon of the salt drink was about twice as high as among the animals not given this drink. When the animals were given two salt drinks, one and four hours after the burn, only about 13 out of 100 died the first day and 17 out of 100 on the second, as compared with about 93 out of 100 dying among untreated controls.

Dr. Rosenthal compared the salt drink treatment for shock from burns with other standard methods of treating shock. No benefit was observed, he reports, from epinephrine (adrenalin), posterior pituitary gland extract, adrenal cortical extract or a synthetic adrenal cortical hormone preparation. Human blood serum showed little effect when injected into the veins of the mice. Mouse blood serum was more effective but not as good as the salt drink.

Whether a salt drink can replace blood serum or blood plasma as life-saving treatment for shock in human victims of burns can not be told until more experiments have been made. The salt drink treatment is based on a different principle from that of replacing lost fluids as by plasma or blood transfusions. In mice, Dr. Rosenthal finds that death, occurring within a day or two after an extensive burn, is closely related to a disturbance of the balance of sodium and potassium in the body as well as to the escape of fluids from the blood stream. The upset in sodium potassium balance seems the most important, and may be the cause of the concentration of the blood and other effects attributed to the loss of fluids in the burned areas. Doses of potassium speeded death in the burned mice, and when this was given with sodium chloride, it antagonized the effects of the salt drink. The strength of the salt drink has to be such as not to upset the fluid balance of the body, and should have about the same osmotic pressure as that of the blood.

Since it is the sodium of the salt that is effective, other sodium salts, such as sodium bicarbonate, might be given if the salt drink proved too nauseating. Salt tablets of the right dose with a glass of water might prove the most practical method for first aid use, if the new treatment develops into one useful for human burn victims.

Further studies on methods of saving those who succumb to burns after the first two days will be made. The studies have so far been limited to effects of treatment for shock, rather than for the burn itself, since in men from 60 to 80 per cent. of the deaths from extensive burns occur within the first few days as the result of shock.

JANE STAFFORD.

ITEMS

HARVARD'S professor emeritus of Arabic, Dr. James R. Jewett, who died on March 31, at the age of 82 years, played a leading part in Harvard astronomy. The most modern Harvard telescope, although not the largest, the 24–33 inch Schmidt-type instrument, was provided by Professor Jewett. This telescope inspired a similar Schmidt telescope installed with Harvard cooperation during the past year at the new Mexican National Astrophysical Observatory at Tonanzirtla. An enthusiastic amateur astronomer, Professor Jewett gave Harvard Observatory his own 9-inch refracting telescope, made by Clark, and he enjoyed seeing it used for instruction and entertainment of visitors on the Observatory's open nights. His last gift will make possible the Annie J. Cannon memorial volume which will contain the work of that Harvard woman astronomer which was unpublished at the time of her death two years ago.

DR. ERNST F. W. ALEXANDERSON, consulting engineer of the General Electric Company, predicted in a science forum address at Schenectady that air traffic of the future will be guided by chains of ultra-short-wave radio beacons, as air traffic of past years was guided by chains of light beacons. They will cross the continent like highways, enabling the aviator to fly above the clouds and yet see his way in three dimensions by radio vision, as unmistakably as if he were looking at rows of street lights on a clear night. An adaptation of the system will guide ships at sea, however thick the fog, so that collisions will have no more terrors for navigators. A revival and perfection of the radio-echo sounding device, tried some years ago on airplanes, was another prediction of Dr. Alexanderson. This instrument was designed to tell the aviator not merely his altitude above sea level but his height relative to the actual terrain he was crossing; also to warn him if a suddenly rising mountain peak loomed ahead.

DESTRUCTION by ultraviolet light of the virus type of disease germ depends on hitting a certain vital spot or "Achilles heel" of the virus, according to Dr. Harvey C. Rentschler, director of research at the Westinghouse Lamp Division. This statement was based on thousands of tests made with the aid of Miss Galina Mouromseff, staff bacteriologist, in which bacteriophage, a virus that destroys bacteria, was subjected to ultraviolet light barrage. "This ability of ultraviolet to inactivate virus," Dr. Rentschler said, "means that science now has an effective weapon to use in the battle against influenza, infantile paralysis and the common cold among other diseases thought to be caused by virus."

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SCIENCE NEWS

Science Service, Washington, D. C.

SPIRAL NEBULAE

THE arms of spiral nebulae, those gigantic pinwheels of the universe, have been discovered to be trailing their central region by Dr. Edwin Hubble, of the Mt. Wilson Observatory. His investigation, reported in the *Astrophysical Journal*, is of importance in the study of the origin and development of nebulae, the most familiar of which is the Milky Way.

Spiral nebulae, comparable in size to our stellar system, are millions of light-years away. Billions of stars, luminous gaseous matter, and dark clouds obscuring portions of the brilliant center form this whirlpool of light.

Dr. Hubble slips the missing piece of the puzzle into place by developing a criterion for determining the direction in which these whirling masses are inclined. We see them as images projected against space and whether they are tilted toward us or away would decide, in light of their spiral pattern, if the arms are trailing or leading.

It has been believed for some time that the dark lanes visible only on the slightly tilted nebulae are the key, but dispute arose as to whether they marked the far or near side. Working with the entire collection of Mt. Wilson photographs, including those made with the aid of the famous 100-inch telescope, Dr. Hubble eventually found a spiral nebula which showed both the dark lanes and the spiral pattern. The dark lines were silhouetted against the central or nuclear bulge, showing that the dark bands unmistakably denote the nearer side. Other nebulae studied support his assumption that the arms were trailing.

From the slant of the spectral lines it is known that all spiral nebulae are traveling in the same direction. Having once determined that direction, Dr. Hubble concluded that the arms of the nebulae are trailing in all spirals.

NEW COSMIC RAY THEORY

COSMIC rays are due to protons which plunge into the earth's atmosphere from outer space, and the proton splits into ten mesotrons. This is the latest theory which Dr. W. F. G. Swann, director of the Bartol Research Foundation of the Franklin Institute, proposes in *The Physical Review*.

Dr. Swann has long contended, in company with many other distinguished physicists, that the incoming particles responsible for the rays are protons. Others have contended that they were high-speed electrons. He now adds a further detail to the theory, that the proton splits into ten mesotrons. This theory, he believes, is the only one that satisfactorily accounts for the variation of cosmic ray intensity with the latitude and altitude.

The proton is the positively charged particle found in the central sun or nucleus of an atom. It has about the weight of the hydrogen atom, the nucleus of which is composed of a single proton, around which revolves a single negatively charged electron. The electron has only 1/1800 the weight of a proton.

The mesotron is the elusive and exceedingly short-lived middleweight particle, with a weight about 1/10 that of the proton. Its life span is only one to two millionths of a second. Consequently many are found high up in the atmosphere, but much fewer lower down. Not many live to reach the earth's surface. During its brief flight, the mesotron parts with most of its energy and degenerates to an electron.

COLOR CHANGES IN ANIMALS

WHEN a chameleon flashes from brown to green in a few seconds, or an eel more sluggishly takes several hours to shift from dark to pallid in skin hue, don't seek the cause for this difference in rates in the nerves of the one animal or the gland secretions of the other. Professor G. H. Parker, of Harvard University, spoke on this subject before the Philadelphia meeting of the American Philosophical Society.

Quickness of color change in some animals, slowness in others is determined primarily by the skin's pigment-containing cells themselves. This is contrary to the zoological doctrine most widely held at present, which states that the quick-changing animals do the trick by means of nerve impulses, while the ones that alter their colors slowly depend on hormones or gland secretions.

This opinion, Dr. Parker said, was based on the examination of only a few animals, and falls down when a score or more species, a wide range of color-changing speeds, are examined. As a matter of fact, the quick-changing chameleon depends on hormones, the slow-changing eel on nerves.

Slowness of response by color cells to either hormone or nerve stimulus has an analogy in a similar slowness in muscle cells. A snail's muscles simply can not move otherwise than very deliberately, while a flea's muscles always contract with a lightning-like snap.—FRANK THONE.

ISLANDS IN THE PACIFIC

TRUK, in the mid-Pacific, is a doomed island. Unless geologic processes now going on in the earth's crust beneath that part of the ocean are stopped or reversed, it will eventually be drowned. The only trouble is that this won't happen in 1943 or 1944—geologic processes are slow.

That Truk is sinking, while other islands that are now enemy strongholds are slowly rising, was pointed out in an address by Professor William Herbert Hobbs, of the University of Michigan, before the meeting of the American Philosophical Society. Professor Hobbs has seen Truk and the other Japanese-mandated islands since they passed under the flag of the Rising Sun. He visited there in 1921, when Japan had just taken over and when our relations with that country were on a much more cordial basis than they have been recently. He was shown many courtesies by the officials in charge, who helped him in the geological studies he was making of the basic geology of the Pacific area.

For geologists interested in the story of mountain-building, most unique opportunities for study are offered by the several curving island chains in the Pacific, from

the Bonins through the Philippines and Indies and far on to the South Pacific archipelagoes and New Zealand. Elsewhere on the earth, whenever a mountain chain has started to grow, it has immediately been attacked by erosion, which cuts it down even as it rises above the general crustal level. These arc-like strings of islands, however, are only the tips of mountain chains now forming as vast upthrust wrinkles from the ocean floor. Erosion therefore plays no part on their long, submerged flanks.

Only on the emersed tips which are the islands have the waves and the weather any chance to do any carving; and this is even a help rather than a hindrance to the geologist. For when an earthquake cycle has boosted the island out of the water another few feet, the waves obligingly carve a notch all around its shores, marking the new level. And if it should sink again, a coral reef forms, indicating the amount of submergence. The island thus serves as a natural measuring-stick for the geological progress of the submarine mountain system of which it is the apex.—FRANK THONE.

INVISIBLE FILM REPELLING WATER

ONE of the most difficult problems faced by radio engineers has been water getting into the porcelain insulators. When that happens, they don't insulate any more, and the set weakens—even stops working altogether. Usual practice has been to treat the insulators with wax; but that is rather impermanent.

Dr. Winton I. Patnode, research chemist of the General Electric Company, has developed a new treatment for these insulators that is said to be about nine times more effective than waxing them, and with permanent results that defy heat, chemical solvents like gasoline, naphtha and carbon tetrachloride, and long exposure to ordinary weather. Objects treated with it simply won't let water wet them. If moisture precipitates on them, it remains rounded up as round droplets, and the wide dry spaces between continue to defy the electricity to pass.

The process is quite simple, but as yet not at all well understood. The objects to be made water-repellent are simply placed in a closed cabinet, and the vapors of one of a group of substances known chemically as the methyl chlor silanes are flooded on them. An after-treatment with ammonia vapor is sometimes desirable, to neutralize corrosive acids that may collect during the moisture-proofing.

Dr. Patnode has been unable to demonstrate the presence of a tangible film on his treated insulators, either with chemical reagents or examination with a high-power microscope. Yet their behavior shows that they are wearing "invisible raincoats."

Numerous other uses are proposed for the new wet-refusing films, most of which must remain undisclosed for the present. One such use, however, promises to make life in the laboratory a lot happier. Everybody has noticed how water rises in a slight curve where the edges of its surface come into contact with the tube or vessel containing it. This curve, called the meniscus, makes it hard to read guages, glass measuring flasks and other laboratory vessels that require highest possible accuracy. If the inside of the glass is given this water-repelling film, the meniscus does not form and the surface is perfectly flat, making readings far easier to take.

ITEMS

OBSERVATIONS on the star-like nucleus of Comet Whipple 2, which was recently visible near the Big Dipper, has led to the discovery of a gaseous compound hitherto unidentified in comets. It is the fragmentary molecule NH_2 produced when hydrogen or methane burns in the flame with nitrous oxide. Although luminous bands of NH_2 have been previously observed in the spectra of other comets, it was their extraordinary strength in Comet Whipple 2 that led to their identification. The observations were made by Dr. R. Minkowski, with the 60-inch reflecting telescope of the Mt. Wilson Observatory. The only other bands in the comet's spectrum besides those of NH_2 that could be identified with certainty were those of the carbon molecule, C_2, which were first described by Swan in the spectrum of the candle flame in 1857. The carbon bands, however, have long been known in comets. Many other bands in Comet Whipple 2 were observed which could not be identified with known gaseous compounds, which serves to emphasize the peculiar conditions that must prevail in the nuclei of comets.

A NEW comet has been discovered by Miss L. Oterma, astronomer of the Turku Observatory, Finland, who is credited with discovering two comets last year. The comet was first seen on April 8 in the constellation of Virgo, which is now easily visible in our evening sky. It is of the fifteenth magnitude and therefore far too faint to be seen without telescopic aid. The new comet is near the celestial equator and moving slowly westward. Harvard Observatory received word of the discovery by way of Denmark and Sweden. On April 8 at 5 P.M., Eastern War Time, the comet's right ascension was 12 hours, 19 minutes, and its declination plus 1 degree, 12 minutes. As comets are named after their discoverer, this will be known as the third Oterma comet.

A STUDY of the little group of stars known as the Pleiades or Seven Sisters has revealed new facts about the nature of the obscuring clouds of interstellar gas throughout our galactic system. The study was carried out by Dr. Walter S. Adams with the 100-inch reflector of the Mt. Wilson Observatory. Nine stars of the Pleiades were selected for observation because their high temperature gave a background against which to detect the dark interstellar clouds. Dr. Adams found that seven of the nine stars show obscuration by both ionized calcium and hydrocarbon gas; whereas two, Asterope and Merope, show obscuration by ionized hydrocarbon only. This is the first case found in which lines of one interstellar gas occur without the presence of ionized calcium. Another interesting point is that neutral hydrocarbon which is prominent in many stars is completely missing from the Pleiades. Dr. Adams concludes that, "The fact that such different interstellar lines are observed in neighboring stars of this small cluster indicates the diversity in the physical conditions of the interstellar clouds and perhaps the limited dimensions which these clouds must have."

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SCIENCE NEWS

Science Service, Washington, D. C.

THOMAS JEFFERSON

THOMAS JEFFERSON'S two hundredth anniversary was given special observance at the annual spring meeting of the American Philosophical Society. For 1943 marks also a bicentennial milestone in the history of the society. It was in 1743, the year of Jefferson's birth, that the little informal club called "Junto," which Benjamin Franklin had got together to discuss scientific and other scholarly matters, was formally organized under the full title which it still retains: "The American Philosophical Society Held at Philadelphia for Promoting Useful Knowledge."

Thomas Jefferson was a young man and Benjamin Franklin was old when the two worked together in the cause of American independence; but the two could meet on common ground at many points. Science, especially physical and mechanical science, was one of the best-established of the common fronts existing between the elderly Philadelphian and the youthful Virginian; both liked to try to find out what made things go, and both had a decided bent towards the invention of ingenious and practically useful gadgets, like Franklin's lightning-rod and heating-stove and Jefferson's improved mold-board plow.

At one point, however, they diverged: Franklin was a city businessman, Jefferson was by choice a farmer. In this, Jefferson was more nearly at one with his fellow-Virginian, George Washington. This aspect of Jefferson's life and interests was discussed at the meeting of the Philosophical Society by M. L. Wilson, director of extension work in the U. S. Department of Agriculture. Owner of a hill farm (for Monticello stands on a mountaintop), Jefferson was one of the country's first practitioners of soil conservation methods, including the contour-plowing that is now being preached as the newest thing in soil-saving devices. He also introduced new plants and improved livestock varieties brought from Europe, and was an early believer in crop rotation.

Jefferson founded the University of Virginia (it is the one boast of achievement carved in his epitaph) just as Franklin was active in the establishment of the University of Pennsylvania. In one of his statements of desirable university policy, Jefferson came out positively for the inclusion of agricultural science among the subjects to be taught—something of a novelty in a day when higher education still centered almost exclusively around the classics. Yet Jefferson is not to be counted among educational leaders who place sole emphasis on the scientific and "practical" to the neglect of the classics and the humanities. He was himself well educated in Latin and Greek, but in his hands the old languages were not "dead," as Dr. Louis B. Wright, of the Henry E. Huntington Library and Art Gallery, pointed out. "In the early years of the republic," Dr. Wright reminded his hearers, "the classics had not yet foundered on the arid shores of pedantry."

Jefferson once declared: "No occupation is so delightful to me as the culture of the earth." Translated into Latin, that could easily be passed off as a quotation from the Georgics, Vergil's great poetic work in praise of country living.—FRANK THONE.

A THEORY OF GRAVITATION

A THEORY of gravitation that makes it a push instead of a pull, thus avoiding the bugbear of action at a distance, and makes it a repulsion deep within the stars and planets, was presented by Anatol James Shneiderov at the meeting of the American Geophysical Union. Mr. Shneiderov holds the Russian degree of "Magister in Military Engineering" and is also a civil engineer. He is at present on the faculty of the George Washington University, where the meetings were held.

There is something occult about the motion of force at a distance, Mr. Shneiderov said. His theory is in a sense a modernized version of the theory of the Swiss scientist Le Sage, proposed some years ago. According to this theory, streams of particles incessantly traversing space in all directions impinge upon the farther sides of two planets or other celestial objects, but are screened from the nearer sides by the planets themselves, and so push them together.

In place of streams of particles, Mr. Shneiderov substitutes streams of energy. These pass through matter, losing energy as they go. He has developed a formula for the force produced which is more complicated than Newton's, but not as complicated as Einstein's. Outside a planet it gives the same force as Newton's law, and agrees with Einstein when account is taken of the increase of mass with the speed.

But inside a planet, Mr. Shneiderov gets very different results. The attractive force diminishes below the surface down to a certain level, where it becomes a repulsion which then increases exponentially the rest of the way to the center. According to Newton, the attractive force diminishes continually and becomes zero at the center. According to Mr. Shneiderov the force around the center of the earth is so great that all atoms are disintegrated, the nuclei stripped of the surrounding electrons. The core of the earth thus becomes an "electronic gas." This explains why the core does not transmit transverse earthquake waves which it would if it were solid as hitherto supposed.

These great forces in the deep interior of the earth are mainly responsible for earthquakes, and Mr. Shneiderov believes that a fuller understanding of them may lead to the possibility of predicting earthquakes long before they happen.—MORTON MOTT-SMITH.

MEASUREMENT OF LARGE QUANTITIES OF WATER

RADIUM in tiny quantities may be used to measure large masses of water, but the method is not as simple as it seems at first glance, was pointed out by Dr. Victor F. Hess, German Nobel prizeman in physics now at Fordham University, at the Washington meeting of the American Geophysical Union.

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Some indirect means is desirable for accurately measuring large quantities of water in reservoirs, where direct weighing is not possible. One method that has been tried has been to dissolve a lot of salt in the water, then collect a sample of it as it comes out of the tailrace of the power plant and determine the salt concentration in that.

Some time ago the noted French physicist, Dr. J. Joly, suggested the use of minute amounts of radium, which diffuse rapidly and evenly in water, but he did not do any experimental work on the method himself. Dr. Hess has done so, making use of a large tank in Pennsylvania, loaned for the purpose by a power company.

Sources of error were found to be more numerous than anticipated. There was a tendency for part of the radium to become tied up in insoluble form with "hardening" chemicals in the river water; this could be partly overcome by adding hydrochloric acid. Minute but variable amounts of radium are naturally present in the water, so that their effect has to be measured in advance and proper allowances made. Even the type of glassware used in the laboratory may falsify results unless great care is exercised. Dr. Hess concluded by cautioning his hearers not to "attempt blindly to set out to measure large volumes of water with too little radium."

LIGNITE DEPOSITS OF THE UNITED STATES

THE huge lignite deposits in the United States are a potential source of war power was reported to the American Society of Mechanical Engineers by Professor C. J. Eckhardt, Jr., and C. W. Yates, of the University of Texas. Only an insignificant fraction of the nation's 939 billion ton reserve is being utilized. But soaring fuel consumption to meet war needs brings increased attention to this low-rank fuel.

Lignite, often called "brown coal," is more widely used in Europe than America. It appears to be a halfway station between wood and coal, occurring at a more youthful age than its true coal relatives.

Lignite contains more water and ash than ordinary coal. But misconceptions are commonly held about the properties of lignite that stand in the way of its more extended use. "The failure to use appropriate grate surfaces has caused this fuel to be maligned with regard to sifting losses from size reduction of the fuel particles as heat is applied and moisture is driven off. Yet the water losses are no greater than those of some of the more admirable fuels and the size reduction while this fuel burns can be rendered inconsequential. The most serious misconceptions relate to its tendency to undergo size-reduction processes while in storage and while being handled."

More than a sixth of the nation's mineral-fuel reserve is lignite. Principal deposits are mainly in Texas, Montana and the Dakotas, where no mountain-making movement of the earth's crust has occurred.

ITEMS

OCEAN current surveys for the Navy will be made this spring on the Atlantic Coast by floating radio robots—boat-like metal buoys with radio masts fifteen feet high. A streamlined meter containing a compass will be suspended from each buoy to record the velocity and direction of the current. It automatically broadcasts this to the mother ship. At the receiving end, the radioed impulses of the meter are recorded by a robot mechanism in groups of three; the distance between two of the "ticks" giving the velocity and the location of the third between them giving the direction of the current. Dr. L. O. Colbert, of the U. S. Coast and Geodetic Survey, speaking before the American Geophysical Union stated that the new radio current meter decreases the number of vessels needed for such a survey as simultaneous observations can be made at several current stations. Another advantage is that the streamlined current buoys can remain at their posts during bad weather and in strong currents with less difficulty than a ship anchored under similar conditions.

A PHOTOGRAPHIC recorder used to replace previous methods of obtaining a series of wind velocity measurements was described at the meeting of the American Geophysical Union by Dr. Leonard B. Corwin, of the U. S. Soil Conservation Service. Dr. Corwin stated that the recorder was developed to secure simultaneous measurements of wind velocity at several different levels where electrical power was unavailable. The dials or faces of several counters were photographed as the simplest and surest way to obtain multiple records. By adjustments, photographic observations could be obtained at intervals of one minute up to an hour or more. Dr. Corwin stated that the photographic recorder "appears to offer a means of obtaining an autographic record of many if not most meteorologic and climatic values." Further simplification of the apparatus is contemplated.

SYNTHETIC plastic material to supplement the available supply of mica necessary in war-used electrical equipment is promised in the near future. Priorities have been granted for the materials to construct a plant where the synthetic product will be made. It is expected that the plant will be in production about July 1. The material is a synthetic polymerized resin. It is reported to have high temperature resistance and low dielectric loss. These properties will permit its use in several types of radio equipment now requiring mica. It will be known under the trade name of Polectron. This new plastic is a product of the General Aniline and Film Corporation. It has been tested for the corporation by the laboratories of the Massachusetts Institute of Technology and those of one of the large industrial companies making electrical apparatus. It has been tested also at Wright Field. Much of the mica now in use is obtained from India and Brazil. It has been called by the War Production Board an urgently needed raw material vital to mechanized warfare, and mica users and fabricators were warned many months ago to conserve the supply in every way possible. One ton of the new plastic, fabricated into mica replacement material, will replace from ten to fifteen tons of the imported block mica, it is expected, thus saving much strategic material.

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Of course, the assumption that the Navy course was built around the MacDougall and Hegner text is incorrect. The course is not based on any particular text, and no text is recommended or suggested by Navy officials in charge of the V-12 program.

But it is an interesting coincidence that the content of the Navy course parallels so closely the content of MacDougall and Hegner's *Biology*. This parallel is, of course, purely coincidental. Nevertheless, it justifies your close study of this outstanding new text if you are planning a biology course for premedical students in the Navy V-12 program.

In this book the authors have made a notable addition to those few elementary biology texts that truly deserve to be called distinctive. Keeping in mind the needs of beginning students and the preferences of instructors, Professors MacDougall and Hegner present an adroit combination of the principles and the types course, in an arrangement that allows an unusual degree of flexibility. To tell the story of biology, simply, yet scientifically, has been the aim throughout. The book is divided into seven parts: The Foundations of Biology; Plant Biology; Animal Biology; General Biology: Organs, Systems, and Their Functions, the Biology of Man; Some Biological Principles and Theories; Applied Biology, Biology and Human Welfare, Conservation; The History of Biology.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE DEATH RATE

THE death rate is rising and the pneumonia situation is particularly serious, it appears from the *Statistical Bulletin* of the Metropolitan Life Insurance Company.

A 5.5 per cent. increase in mortality among the company's industrial policy holders was recorded for the first quarter of this year as compared with last year's figure. For the country as a whole, an even greater rise in mortality has probably occurred. In the 90 major cities of the United States there were 9.2 per cent. more deaths reported for the first 13 weeks of 1943 than for the corresponding weeks of 1942. In New York City the death rate so far this year is about 8.5 per cent. higher than for the same period last year.

The war can not be blamed directly for the increase in mortality, it appears. Among the company's industrial policy holders, the rate for deaths from enemy action for the first quarter of 1943 was more than twice that for the first quarter of 1942, but this, it is said, "does not account for the unfavorable turn in mortality for 1943. Most of the rise in rate this year has resulted from other causes."

Pneumonia seems to be the chief factor here. The death rate for the first quarter of 1943 is low compared with rates prior to 1941, but is 21 per cent. higher than last year's rate for the first quarter. Virus pneumonia, also called "atypical pneumonia of unknown etiology," has made up a large proportion of pneumonia cases during the past season, and this type of pneumonia is not affected by sulfa drug treatment.

Seeking to allay the fear that the rise in the pneumonia death rate presages another world-wide flu-pneumonia epidemic, the Metropolitan Life Insurance Company health authorities point out that virus pneumonia is different from both influenza and the pneumonia which accompanied influenza in 1918.

"Nevertheless, the situation needs careful watching. The war effort would be seriously hampered by an increase in pneumonia mortality or even by a continuation of the recent level."

Meningitis mortality also increased sharply in 1943. Disquieting also is the increase in deaths from cancer, diabetes, cerebral hemorrhage, diseases of the coronary arteries and angina pectoris and the chronic heart diseases. With the exception of diabetes, the 1943 death rates for all of these are the highest on record.

Fatal accidents in the home have increased, in spite of the fact that there is very little unemployment and less time is spent in the home now than before the war.

Only cheerful spots on the current health picture are the marked decline in maternal mortality, especially noteworthy in view of the increased birthrate, and the continued decline in the tuberculosis death rate which was 6.8 per cent. less in the first quarter of 1943 than in the same period last year.

INTERIOR HEATING IN METAL WORK

HIGH-FREQUENCY electric field heating in the interior of materials is now used in case-hardening metal machine parts, in the manufacture of plywood and in many other industrial operations. Developed only within the past few years, it is a process similar to the one used by physicians in electro-therapy, in which heat is applied internally to parts of the body. "Penetrating heat" it has sometimes been called by them, to distinguish it from surface heat.

The manufacturing of plywood illustrates how the high-frequency electric field is used. A metal sheet, connected to one terminal of a high-frequency transformer, is placed in the center of a stack of glue-coated veneer sheets two or more feet high. The other terminal is connected to the upper and lower plates of the plywood press itself. Pressure is applied, and at the same time electric energy sent from the middle metal sheet to the plates of the press. The heat sets the glue. Two heavy slabs of plywood may be formed, or many separated plywood boards may result, depending upon the glue application.

In this interior heating, a high-frequency electronic oscillatory system is generally used. It is basically similar to a radio transmitter but usually more powerful. The oscillator is operated on direct current, and gives an alternating current of frequencies from a few cycles to many millions per second, depending upon the setup. In passing from one terminal to the other, much of the electric energy is turned into heat. Case-hardening of small machine parts such as gears and bearings is now being done by a similar electric heating process. In case-hardening only the surface wearing area is hardened. Tinplate, applied to other metals by the electrolytic method, requires polishing. This also is now done by a similar high-frequency electric field process.

Other uses include the heat treatment of tobacco without removing it from the hogshead, and the killing of insects in grains and cereals. Other industrial uses are made of the process, and many additional ones are promised for the near future.

THE 1943 PRODUCTION OF BEET SUGAR

SUGAR-MAKING, which ought to be the sweetest job in the world, is always running into something sour. This year it's the unwillingness of the beet-raising farmers to put in more than two-thirds of the million acres they had expected to plant. Since about a third of our national sugar supply comes from domestically raised beets, this means a reduction of roughly 10 per cent. in the sugar we'll have next year—unless the shipping situation improves to the point where more cane sugar can be brought in from the tropics.

Labor shortage is primarily to blame for the situation. There is a great deal of "stoop labor" involved in raising beets, and since high-wage war-industry plants have

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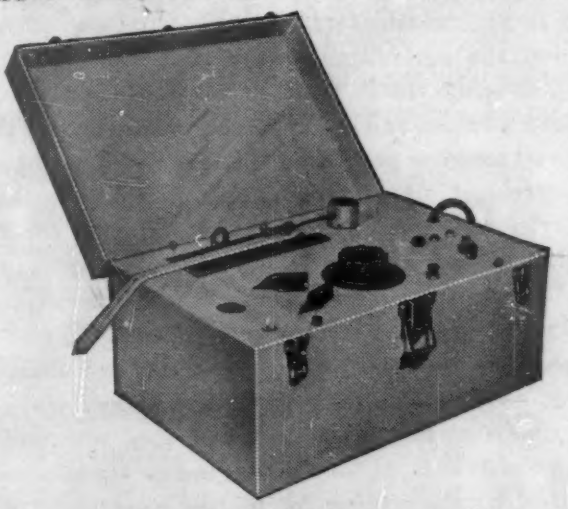

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sprung up in practically every beet-raising area in the country, beet-field hands simply aren't to be hired.

Officials of the Department of Agriculture are less worried than the sugar manufacturers. They point out that the acres that will not raise beets this year will raise other crops, all of them needed by the armed forces and by workers on the home front. Indicated replacement crops are mainly potatoes, beans and alfalfa—the latter, of course, to become meat and milk, *via* the farmyard feed rack.

This labor shortage trouble crops up just as the beet-sugar industry had been helped out of another bad fix—a threatened shortage of seed. Thanks to the plant breeders of the Department of Agriculture and state experiment stations, we have become independent of European beet-seed growers, as we are becoming independnt of foreign garden-seed growers.

The story of American sugar-beet seed development is told by Dr. G. H. Coons, of the U. S. Department of Agriculture. Prior to the first World War, although we had something over two thirds of a million acres in sugar-beet production, we relied entirely on European growers for seed. They had the experience, also cheaper labor, so that seemed the best thing to do. There had to be long and anxious negotiations, to get even a trickle of seed through from blockaded Germany. We even had to put up a bond to make a return shipment of the empty gunny-sacks!

At the same time, American sugar-beet fields were under a destructive dual attack here at home. In the West, beets were literally curling up and quitting, under the scourge of a virus disease called curly-top, which crippled their leaves and made them unable to manufacture sugar in the normal way. In the East, there was an almost equally destructive disease called leaf-spot, caused by a fungus.

To meet these and other threats to the Great American Sugar-Bowl, investigators of the Department of Agriculture and the agricultural experiment stations of sugar-beet producing states went to work to develop disease-resistant strains, and to introduce them into cultivation. They succeeded in producing the kinds of new sugar beets they were seeking. No one strain is good for the whole country, for the curly-top-resistant kind good for Western conditions is not immune to the leaf-spot prevalent in the East. Conversely, the leaf-spot-resistant variety can not stand up to curly-top in the West. There are also special strains fitted for local conditions of soil and climate, that are not good outside their particular areas.

In the West home production of seed was undertaken during the 1930's, so that the region as a whole was little disturbed by the cutting off of beet seed imports by the second World War. Growers in the East had let the job of seed production slip back into the hands of European growers, until the total beet seed imports had climbed to around 15,000,000 pounds in 1937, as compared with 13,000,000 pounds grown in the United States—principally in and for the Western fields.

Imports slumped heavily during the first part of the war, though substantial quantities still came in until 1941, since when practically no seed has been received from abroad. Domestically produced seed, however, after a slump from well over 13,000,000 pounds in 1938 and 1939 to not much more than half that in 1940, has now gone up to the hitherto unapproached peak of 18,000,000 pounds.—FRANK THONE.

ITEMS

THE comet discovered this spring by Miss L. Oterma, of Finland, is increasing in brightness. When first seen on April 8 at the Turku Observatory, the comet was recorded to be of the fifteenth magnitude. Recent observations agree that it is now of the ninth magnitude. The new data were relayed to Harvard College Observatory. Early reports showed the comet in the constellation of Virgo, and moving slowly westward. Dr. Otto Struve, director of the Yerkes Observatory, Williams Bay, Wis., reports that on April 30, at 10: 42 P.M., the comet's right ascension was 12 hours, 9 minutes, 58 seconds, and its declination plus 2 degrees, 25 minutes, 10 seconds. On May 2 at 10: 45 P.M., the comet's right ascension was 12 hours, 8 minutes, and 13 seconds, while its declination was plus 2 degrees, 28 minutes, 57 seconds.

THE discovery of new ore deposits of the rare metal tantalum in New Mexico, which promise high productivity, is welcome news to war manufacturers who use this metal and its compounds. Tantalum's first commercial use was in electric lamps, then it jumped into prominence by its use in radio tubes. Because of its power to resist corrosion, it is used in surgical and dental instruments, electrical contacts, pump and valve parts and temperature control apparatus. Carbides of tantalum are used in wire-drawing dies, steel-cutting tools, wear-resistant parts of machines, and in dies for cold-nosing artillery shells. Although tantalum ore has been mined in Wyoming, South Dakota and New Mexico, the principal source has been abroad. The new deposit, if it meets expectations, may supply the principal needs.

A METHOD for storing fragments of nerves for future use as grafts, somewhat as blood is now stored for future use, was announced by Dr. Paul Weiss, of Chicago, at the meeting of the American Neurological Association. The nerve fragments can be stored indefinitely without losing their effectiveness as grafts. They are frozen at 150 degrees below zero Centigrade, dehydrated in a high vacuum, sealed in and stored in the dry condition. They are rehydrated before use. "This treatment," Dr. Weiss said, "leaves the histological, biophysical and biochemical properties of the nerve essentially unharmed. When grafted, such nerves are readily and fully pervaded by regenerating nerve fibers, much as if they were living." Sleeves of fresh or frozen-dried arteries are another aid to the neurosurgeon. "With their aid, nerve stumps can be spliced without being sewed together and "practically ideal nerve regeneration has been obtained," Dr. Weiss reported.

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SCIENCE NEWS

Science Service, Washington, D. C.

PARICUTIN, MEXICO'S NEW VOLCANO

I HAVE just seen Mexico's new volcano, Paricutin, from the air and it is like having a grandstand seat at the geologic drama that shaped the face of much of this country. Dr. L. C. Graton, of Harvard, and I flew to Uruapan from Mexico City in two small planes provided by Dr. Gonzalo Bautista, governor of the State of Puebla, and piloted by Captain Luis Martel and Lieutenant Carlos Cortez, of Puebla's aviation school.

The air around the volcano in late afternoon proved too dusty for successful aerial observation, but a start early next morning gave almost perfect conditions for observation. We saw Paricutin nestled among dead crater peaks, each of which in past geologic time must have had a few months of life. A great tower of smoke and dust billowed upward, with outbursts about every twenty seconds, showering red-hot pumice on the sides of the cone, which in February began to arise out of what was then a cornfield. Around the cone lay a great lava flow formed during past weeks, while to the northeast could be seen the little village of San Juan Parangaricutiro which is being smothered under several feet of volcanic ash that lies like blackish-brown everlasting snow over everything.

Our little plane buzzed about the erupting cone, keeping away from flying débris that might puncture the wing fabric or unbalance a propeller by an unlucky hit. Both planes twisted and turned for angle photographs that should be helpful to Dr. Graton in interpreting the volcano's geology.

The pilots and I spent eight hours on the previous night making a trip overland, twenty miles by airline but longer by auto, over ash-choked roads and by burro over trails for the last three miles, to the rim of the depression in which the volcano lies. Outbursts of flame lighted the countryside for miles around, and falling incandescent sand outlined the cone. A soft, harmless rain of volcanic sand pattered down as we clambered by volcano light over lava still steaming and hot to the touch.

Our ground and air views of America's latest volcanic blister impressed on us that nature is still building the earth and that study of such infrequent outbursts should give new knowledge of how the rocks of earth were manufactured. Since our food is grown on earth made of these rocks, and since our metals for war and peace come largely from deposits in molten magmas associated with volcanic action, new practical knowledge should come from studies of Paricutin.

As we flew over the Mil Cumbres (Thousand Peaks) region between Mexico City and Morelia, we realized that each of these old cinder cones had its brief days of fire and that although the earth is young here, geologic action was old when man began to record history. There are volcanic cones by the tens of thousands in Mexico, yet only one other eruption like Paricutin is recorded. That was in 1759, when a cone called Jorullo, about fifteen miles from Paricutin, was formed.—WATSON DAVIS.

GLASS WALLS IN HOMES OF THE FUTURE

THE homes of the future with sliding glass partitions that can be made transparent or opaque at will were described by Dr. Alexander Silverman, head of the department of chemistry of the University of Pittsburgh, in an address before a recent meeting of the American Ceramic Society. By sandwiching light-polarizing material in glass, then crossing two plates in a double wall construction, an opaque partition will result. When one of the plates is slid back, the partition will become transparent, permitting light to stream in.

Colored plate glass walls with artistic continuous metallized decorations was another possibility cited by Dr. Silverman. Electricity passing through the decorations would heat the room. Glass floors could be metallized like the walls, or glass foot-warmers designed as hassocks could be used. If additional heat were necessary portable stoves of artistic metallized glass might be designed. "A room at sixty degrees, insuring warm feet and uniform radiation toward the body from all sides, would be more comfortable," Dr. Silverman pointed out, "than to-day's home at seventy degrees or higher."

Glass construction combined with heating elements can also have built-in lights, thus producing attractive heating and illuminating effects. Tempered glass doors, either clear or opaque, may lead from one room to another and cover cabinets and closets. By the recently developed treatment of sheet glass to produce thin etched films only about a molecule thick, almost all reflected light glare can be eliminated.

Although glass plates can be used for both interior and exterior construction, glass brick and hollow tile are likely also to have increased use. The blocks will be produced in various colors, opaque, translucent, transparent. Artistic design will evolve from the more utilitarian approach now used in modern factory construction.

Glass wool will be more widely used for insulation. It is constantly being made lighter and is now available in a form weighing only a half pound per cubic foot. A four-inch layer of glass wool has the heat insulating value of a fourteen-foot concrete wall, it is claimed.

In the temporary housing provided for our Armed Forces in the Arctic regions, porous glass materials, especially wool, are employed to keep out the intense cold. Glass fabrics will also find increasing use in motor generators, in cables, and as battery insulators.

THE PHYSICAL EXAMINATION OF CHILDREN

A PHYSICAL examination of every boy or girl should be made before he or she is granted a work certificate, was stated by Miss Katharine L. Lenroot, chief of the U. S. Children's Bureau, at a press conference in Washington. The "special measures" for the protection of working boys and girls of high-school age called for in President

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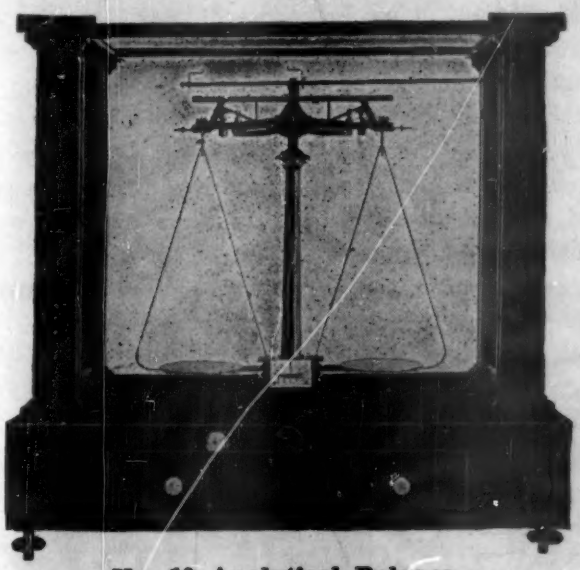

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Roosevelt's proclamation of May 1 as Child Health Day were explained at the conference.

It is estimated that under the stimulus of war more than 2,000,000 boys and girls between 14 and 18 years of age were employed as of October, 1942. More than 3,000,000 were employed during the 1942 summer vacation. An even larger number is expected to be at work this summer.

The physical examinations, Miss Lenroot explained, are needed to make sure that a child with defects of vision or hearing, with incipient hernia, or with unsuspected tuberculosis or heart disease, is not subjected to work which will further impair his health. Many such children should not work at all. Others might work in certain jobs under careful supervision.

Too long hours of work are another health hazard to boys and girls of high-school age. The child labor laws of 42 states now have a maximum work week of 48 hours or less for workers up to 16 or 18 years in a varying range of occupations. No child under 18, the Children's Bureau maintains, should be permitted to work more than eight hours a day or 48 hours a week either on farms or on other jobs.

Part-time jobs after school should be limited so that the combined hours of school and work do not exceed this total, except that as school is likely to be different from a job and less strenuous, some boys and girls of 16 and 17 may be able to put in a total of 9 hours a day on school and job together.

Some jobs have basic health hazards, such as exposure to lead, carbon disulfide, chlorinated solvents and benzol, which, as Miss Lenroot pointed out, are more dangerous to boys and girls under 18 than to other workers.

ELECTRIC FISH

ELECTRIC fish will hardly power war industries, but knowledge of their "shocking" ability may eventually lead to better understanding of how our own nerves work. New research on these strange creatures has just been reported by Dr. R. T. Cox, of New York University, in *The American Journal of Physics.*

Experiments with three small electric eels were first conducted by Dr. Cox and his associates. When the eels were gently prodded, the scientists' instruments recorded quick electrical pulses as high as 200 volts, lasting about two thousandths of a second. These discharges followed each other in trains of three to five. Single weak discharges come from the rear half of the eel; one of them always preceding a train of major discharges, probably serving as a warning signal to enemies.

When an eel discharges from fear of enemies or to obtain prey, it serves as electrical signal for other eels nearby to close in. In fact, it was discovered that eels could be called by producing a current in any manner. When placed in a weak electric current an electric fish swims in the direction of increasing current density, no matter which way the current is going. But in a strong electric current, it swims toward the negative pole.

"This sort of telegraphic communication very likely compensates the electric eel rather well for his partial loss of sight," Dr. Cox states, "the better so in that he commonly lives in muddy water in which the clearest eyes could see no farther than a few feet."

Tests were also made on the largest of all electric fish, Torpedo occidentalis, found off the north Atlantic Coast. Measurements showed a maximum voltage of 220 volts. Peak power of the torpedo was calculated to be a little less than one horsepower per pound of electric organ. These are values for an instant and would be very much less for electric activity over a longer period of time.

ITEMS

BETTER first aid treatment for burns and wounds is promised by a new methalose gauze dressing developed by Dave Brady, Robert Bauer and Fredrick F. Yonkman, pharmacologists at Wayne University, Detroit. A soothing, healing water-soluble preparation, easily compounded and applied, are the advantages cited in a preliminary report to the American Pharmaceutical Association. Sulfanilamide and sulfathiazole, infection fighters, are dissolved in the chemical, propylene glycol, then added to a solution of alkyl cellulose. Sprayed on loose mesh gauze, this mixture makes a durable elastic pressure bandage. Adhering readily to injured areas, the gauze tends to prevent loss of fluid and plasma proteins. The dressing can be removed at any time by soaking in water or salt solution. Excellent first aid treatment is thus obtained, the researchers point out, without the disadvantages of greasy ointments or astringent precipitants, such as tannic acid, that kill cells in the injured area, thereby delaying healing.

A DESTRUCTIVE enzyme which destroys the vital red blood cells during certain diseases may be ever present in our bodies. Ordinarily an inhibitor in the tissues and blood serum holds the enzyme in check. Evidence that this mechanism exists is reported in *Nature* by Brian Maegraith, G. M. Findlay and N. H. Martin, of the West African Force. Certain tissues, such as the lung, liver and kidney, will destroy washed red blood cells suspended in salt solution, the scientists observed. But this action is checked by adding blood serum. Addition of a minute bit of the poisonous chemical, sodium cyanide, or heat application also inhibited blood cell destruction. Men, monkeys and guinea pigs have been used in the experiments. So far it appears that the cell destroyer in an animal acts only on its own species, while the inhibitor will also protect the blood cells of other animals. Discovery of this action, if substantiated, will aid those trying to combat lytic anemias, such as the mysterious blackwater fever to which the armed forces are exposed in tropical areas.

DEVELOPMENT of a yeast powder suitable for human food and plans for the first manufacturing plant for its production, to be set up in Jamaica, are announced in reports reaching Washington from England. It was developed from a strain of Torula utilis by Dr. A. C. Thaysen and colleagues, of the Department of Scientific and Industrial Research at Teddington, England. In the *Lancet* the yeast food is described as having a "slight, not unpleasant taste," and as growing rapidly and being a source of good protein as well as all the B vitamins. The first plant for its manufacture is to be set up in Jamaica because of the availability there of molasses on which, with the addition of ammonium salts, the yeast can be economically grown.

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SCIENCE NEWS

Science Service, Washington, D. C.

A NEW SUNSPOT CYCLE

THE sun has entered on a new 11½-year sunspot cycle, during which the freckles on his face will become more and more numerous for half that period, and then wane to a minimum in 1954 or 1955. The first group of spots identified as belonging to the new cycle have been photographed at the Naval Observatory by Mrs. L. T. Day. It was observed and its magnetic polarity noted by Edison Hoge at Mt. Wilson Observatory, Calif.

The first indication that the new spot group is the first of a new sunspot cycle was given by their position, well away from the sun's equator. The last spot group of the old cycle, close to the equator, was visible at the same time. Then an instrumental check-up showed that their magnetic polarity is opposite to that of spots in the cycle just closing. This reversal of polarity is a "sure sign" of the opening of a new cycle.

Sunspot abundance has been shown to have a direct relation to radio reception. When they are most numerous, the sun is giving off intenser streams of atomic particles, which affect the height of the world's "radio roof," the Kennelly-Heaviside layer, and hence the range of radio signals. Their possible effects upon terrestrial weather of solar radiation connected with sunspots is still a much-debated point.

Several notable particulars were pointed out in the wire from Mt. Wilson Observatory which notified Science Service of the first observations made at that place: "The first sunspot group definitely belonging to the new cycle was observed by Edison Hoge on May 16 at 9 A.M., PWT, at the 150-foot tower telescope of Mt. Wilson Observatory.

"The spot group extended from heliographic latitude south 40 degrees to 44 degrees, and had magnetic polarities opposite to spots of the old cycle in the southern hemisphere. It thus satisfies the two fundamental characteristics of spots of the oncoming cycle: that it be in a latitude much greater than the average latitude for sunspots (15 degrees), and that it have a magnetic polarity opposite those of spots of the old cycle in the same hemisphere.

"This is the first time since 1889 that the first spot of the new cycle has been so far south of the equator. The first spot of the present old cycle was seen on October 10, 1933, in latitude 26 degrees north.

"The spot appeared near the edge of the sun's disk that is being carried from view by the solar rotation. When last observed on May 17, it was increasing in area. The spot will vanish on May 19 and if it survives the journey on the side of the sun turned away from the earth should reappear on June 3."

THE PRODUCTION OF PENICILLIN

THAT the production of penicillin, the chemical from mold, which outdoes the sulfa drugs in curing many kinds of wound infections and germ diseases, is now being pushed to the utmost to make it available for our armed forces, is reported by Dr. A. N. Richards, chairman of the Committee on Medical Research of the Office of Scientific Research and Development, in the *Journal* of the American Medical Association.

The use of penicillin to treat soldiers returned from the Pacific area with unhealed compound fractures, osteomyelitis and wounds with longstanding infection was started six weeks ago. Results of this treatment started at Bushnell General Hospital, Brigham City, Utah, have been so encouraging that plans are now being made to continue studies of its value in treating both wounds and venereal disease in sixteen Army hospitals. The Navy plans similar though less extensive clinical trials of penicillin.

Production of penicillin, in spite of intense efforts to meet military medical needs, has in no instance gone beyond the pilot plant stage. In most plants it is still in the laboratory stage. Some sixteen drug manufacturing companies are now engaged in its production or intend to be soon. The supply for civilian needs in the near future will be very limited, he states, unless production expands at a greater rate than can now be foreseen.

The chief handicap to large scale production lies in the fact that the mold produces only very limited amounts of the germ-fighting chemical. An exceptionally high yield would be in the order of about one thirtieth of an ounce by weight from about twenty quarts of culture medium on which the mold that produces penicillin is grown. And it takes days of mold growth for production of this minute amount.

Discovered by Dr. A. Fleming, of St. Mary's Hospital, London, in 1929, the curative possibilities of penicillin were first announced in 1940 and 1941 by Professor H. W. Florey, Dr. E. Chain and collaborators of the University of Oxford. Following a visit to this country by Professor Florey, and with the encouragement of the Medical Research Committee and the National Research Council, research looking toward the production of penicillin was started in the fall of 1941 by Merck and Company, E. R. Squibb and Sons, Charles A. Pfizer and Company, the Lederle Laboratories and perhaps others.

More than 300 patients have been or are being treated with penicillin and Dr. Richards states that "there is good reason for the belief that it is far superior" to any of the sulfa drugs for staphylococcus aureus infections with and without blood poisoning, including acute and chronic osteomyelitis, cellulitis, carbuncles of the lip and face, pneumonia, empyema and infected wounds. Penicillin is also extremely effective in treating hemolytic streptococcus infections, pneumomoccus pneumonia and gonorrhea.

TOOTH DECAY

TOOTHACHE may become a rare occurrence when an ideal diet is eaten throughout childhood. This hope is raised by three years of experiments reported to the American Dental Association by Dr. Julian D. Boyd, of Iowa City.

After observing children at the State University of Iowa for 17 years and making an intensive study of more than 200 children during the project just completed in

Physical Chemistry

By F. H. MacDOUGALL

Maintaining the same high degree of scientific thoroughness and rigorous treatment which characterized the first edition, this revision brings all material completely up to date. There is a new section on liquid crystals and glasses and a new section on the technically important subject of the theory and use of the glass electrode. The discussion of unclear reactions and artificial radioactivity has been amplified. And of great importance to students of colloids and catalysis is the different and more exact derivation of the Gibbs' Adsorption equation. *Ready May 18th. $4.25 (probable)*

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By SAMUEL R. DETWILER

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Long the standard work on its subject, this book has now been thoroughly revised and brought up to date by Professor Buckman. For this edition the whole book has been rewritten to incorporate much new scientific data on the chemistry and biology of soils. There is important material on moisture from the energy point of view and on the control of soil moisture; on colloidal clays, humus, and soil organisms and their enzymic effects; on soil reactions, buffering, pH correlations and liming. The whole book is clearly written and well illustrated. *Ready in June. Illustrated. $3.75 (probable)*

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By KARL A. STILES

This manual provides a full year's work in all aspects of animal biology, covering the important biological facts as well as the techniques for studying them in the laboratory. It has been prepared for use with the recently published fifth edition of Hegner's *College Zoology*, but is also readily usable with any text. As teaching aids, the book contains many demonstrations, questions and problems for class discussion, materials for tests, full bibliographies, and a glossary of scientific terms. *Ready in June. Illustrated. $2.50 (probable)*

The Macmillan Company, 60 Fifth Avenue, New York

collaboration with the late Dr. Charles L. Drain, Dr. Boyd says: "Surely, the dietary approach offers the most effective means of attack on the problem of caries now available, and furthermore is one which is in step with current policies for the furtherance of public health. With prevalent improvement of children's diets, the seriousness of dental caries as a public health problem will decline to minor proportions."

Evidence that sugar content of the diet is probably of secondary importance will be presented in a forthcoming report. The diet of each child included in the studies was designed to be as near the nutritional ideal as possible. A strict regimen was possible because all the children were under medical supervision because of diabetes.

Possibility that the disease itself had influenced the rate of decay was eliminated; the amount of fluorine in the water, considered a factor in preventing decay, was also taken into consideration. It was concluded that diet alone influenced the rate of decay.

Public Health Service statistics indicate that the children in the area studied might expect to develop decay in two new tooth surfaces each year during the early teens, but the children observed by Dr. Boyd averaged only a fifth as much decay as expected on this basis.

FLOODS

No major industrial damage is to be expected from the floods in the Midwest, for they are not occurring in industrial areas. Our floods are doing damage to agriculture, and to some extent to rail and highway transportation—which is bad, to be sure, but not to be compared with what hit the Ruhr valley industries when the bomb-loosed wall of water roared down on them a few nights ago.

To inflict comparable flood damage to an industrial area in the United States, the waters around Pittsburgh would have to go on a rampage. The Pittsburgh region is the one great steel-making and heavy-industry area in this country liable to river-borne disaster. High water has been on the Monongahela and Allegheny and upper Ohio rivers in the past, and can be expected again—but not this year. Flood time in those valleys is late winter or early spring. By mid-May, flood-making weather conditions have shifted well to the west; now is the time for floods on the lower feeders of the Ohio, and in the slow, flat rivers of the prairie and plains regions west of the Mississippi.

Spring floods are to be expected as a more or less regular thing, according to meteorologists of the U. S. Weather Bureau. As winter draws to a close, warm, moisture-laden air moves up from the Gulf region, meeting the retreating cold air of winter on a long front extending in a general northwest-to-southeast direction. At about this time of year, the front stretches from the lower Great Plains to the middle Great Lakes.

Normally, a series of late spring storms may pour rain on the Midwest for several days, bringing flash floods to the smaller rivers and perhaps swelling the larger ones to highwater mark. But as a rule these storms pass over before really bad floods occur.

This time, we unfortunately got what happens once a generation or so: An unusually rain-rich atmospheric situation develóped, and then stagnated, with the heavens weeping over the same stretch of country for just about a solid fortnight. And so the floods came.

ITEMS

SUCCESS in the first trials of a new method of treating goiter by medicines instead of by surgical operation are reported by Dr. E. B. Astwood, of Harvard Medical School, in the *Journal* of the American Medical Association. The medicines used are thiourea and thiouracil. They have the unique property of inhibiting the function of the thyroid gland, actually, it is believed, preventing production of its powerful hormone. Patients with the kind of goiter in which popping eyes, extreme nervousness and thinness are symptoms suffer from too much thyroid hormone. This excess hormone drives the life processes at too fast a pace and even acts as a poison in its effects on the heart. Operation to remove part of the gland and thus reduce the amount of hormone produced has so far been the chief method of treating the condition. The results reported by Dr. Astwood suggest that patients in future may not need to have this operation but can have their too-active thyroid glands kept under control by taking daily doses of thiourea or thiouracil.

COD liver oil and other fish oils may prove to be a source of a high blood pressure remedy, was reported by Dr. Arthur Grollman and Dr. T. R. Harrison, of the Bowman Gray School of Medicine at Wake Forest College, to the New York meeting of the Society for Experimental Biology and Medicine. Fish body and liver oils, they discovered, contain a substance which is effective in reducing high blood pressure in rats. The substance is not the same as vitamin A, which is contained in fish liver oils and which some have believed has a blood-pressure reducing effect. It is, however, similar to the kidney extract hailed a few years ago as a potential remedy for high blood pressure. Both the kidney extract and the fish oil substance can be given by mouth. Both reduce the blood pressure slowly and have a relatively prolonged effect compared with other substances that reduce high blood pressure. The blood-pressure reducing substance, however, is present in only small amounts in animal kidneys. Fish oils, on the other hand, are relatively potent in reducing blood pressures and are readily available. Therefore, in the opinion of the investigators, they "offer greater promise than kidneys" as a source of a blood pressure remedy.

A NEW aid to protect the hearing of workers in noisy industries, such as shipbuilding, and which promises to be "the solution for certain industrial ear problems" is reported by Dr. David A. McCoy, of Boston, in the forthcoming issue of the *Journal* of the American Medical Association. It consists of an ear mold of transparent plastic lucite, made to fit each worker's ear. This custom-made feature provides a good fit with no leaks of noise and one which is comfortable to wear all day. The ear mold reduces the intense and high-frequency noises, which are distracting, painful and deafening, but lets the wearer hear people talking without trouble. A further advantage of this plastic ear mold is that it shuts out the flying balls of hot slag which are a danger to the ears of welders and chippers.

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If you are planning to teach a course in biology for pre-medical students and have not had an opportunity to examine this text, send for an examination copy.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE DISEASE PROBLEMS AFTER THE WAR

DISEASE and infection present gigantic problems to our armies fighting a global war, Professor K. F. Meyer, head of the department of bacteriology at the University of California, told the Western Section of the American Chemical Society. In wars, Professor Meyer pointed out, there has often been a much higher mortality rate from disease than from wounds. In the Crimean War, for example, there were 50 deaths from wounds to 192 from disease, while in the 1914–1918 World War the relation was 138 due to wounds and 115 from disease.

Not only is there the question of the health of the troops during the war, but of contacts among the home population when peace comes. When all these men come back, Professor Meyer said, we shall have carriers of all sorts of diseases. We must be prepared in civilian set-ups for possible eventualities. We remember that 1,000 people died of cholera in one month in Sacramento, Calif., during the '49 gold rush. The Army and Navy Medical Corps, working in conjunction with committees of the National Research Council, are developing every possible means of reducing the impact of these diseases to a minimum.

In the offices of the Division of Medical Intelligence there are on the walls maps of the world showing last minute data on the location of the various communicable diseases. Extensive outlines of the diseases likely to be met are prepared and given to medical officers before embarkation to the battle front.

In North Africa diphtheria appears in the form of skin ulcers which do not heal. In the caves of Tobruk there were sandflies and ticks that transmit fever. In Trinidad there are vampire bats. About 4 per cent. of these bats carry the rabies virus in their saliva. They bite the peoples' toes at night and the rabies appears as an ascending paralysis that looks in many ways like infantile paralysis. It was necessary that the bat population be reduced. This campaign and one against the mosquitos in that region were planned by the Medical Intelligence.

"Among the so-called 'filth' diseases, typhoid is licked since all troops get immunization," Professor Meyer said. But when our boys come home they may bring back dysentery in various forms." Dysentery vaccines are being studied but they are still in an experimental state. Sulfaguanidine has revolutionized the treatment. This disease will have to be controlled by environment, such as suppression of flies and proper disposal of excreta. This means continual vigilance.

We shall also have contact with cholera, Professor Meyer pointed out, since we are going close to the birthplace of cholera in the Ganges delta. There is a vaccine, but the degree of protection afforded is not definitely known. The Japs have used cholera vaccine since 1904. In fact, the best strain is a Japanese strain. The disadvantage is that revaccination is necessary every three months.

Among the insect-borne diseases we find malaria, which is more frequent in the tropics. This disease is not conquered. We need a real phophylactic. We now have only a suppressive, and a person may carry malaria for years in his blood. The control of this disease will have to be through control of mosquitoes. But how can any one prevent them from breeding in the hills, for example, of the Owen Stanley Mountains, or in West Africa? The medical officer can only see that the men sleep under mosquito nets and charge the atmosphere of the tents with insecticidal spray.

Against yellow fever the army has a vaccine which gives 100 per cent. protection.

Bubonic plague is always a possibility. This scourge has played an important role in many previous wars. It is insect-borne but once started may be passed from man to man in the pneumonic form. Both a vaccine and sulfa drugs may help fight plague.

Typhus is an ever-present threat. The British found typhus in Egypt. It is apt to be in any country where the population is louse-infested. "Some believe this can be handled by vaccination," Professor Meyer said, "but I have yet to be convinced."

In New Guinea, Sumatra, Burma, and Thailand there are mites that transmit a type of spotted fever similar to the swamp fever of Japan. In North Africa troops will probably experience similar diseases carried by ticks. In Central Africa we find sleeping sickness. To combat this we have a prophylactic, Bayer 205, which gives protection for three months.

There are also many other medical problems in a global war. In desert warfare heat-stroke must be dealt with, and sinus infections that tend to flare up. In the swampy battlegrounds there are liver flukes. In our army of eleven or twelve million men we shall find only the particularly fit individuals can be sent into certain regions. A great many who have been sent will have to be returned and replaced by others.

PENICILLIN AND GONORRHEA

RAPID recovery from gonorrhea in five patients who had not been helped by sulfa drug treatment was achieved by the new remedy, penicillin, is reported by Dr. Wallace E. Herrell, Dr. Edward N. Cook and Dr. Luther Thompson, of the Mayo Clinic, in the *Journal* of the American Medical Association.

Penicillin, which is obtained from common mold similar to that which grows on bread, is available only in limited amounts. It should, therefore, be reserved as a drug of last resort in treating gonorrhea.

Some strains of gonococci are so resistant to sulfa drugs that the patients fail to recover even with large doses and several courses of treatment. Laboratory tests showed that such sulfa-drug-resistant strains would yield to fairly small amounts of penicillin. The patients treated at the Mayo Clinic had been sick with gonorrhea for from five weeks to eleven months and had all had what would be considered adequate sulfa drug treatment. They began to get better within a few hours, in one case within five hours, after the penicillin solution started dripping into their veins, and in from two to four days were able to leave the hospital completely free of the infection. Lab-

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oratory tests showed the germs had been banished in from 17 to 48 hours. The penicillin was given by continuous drip into the veins. No toxic effects or discomfort to the patient resulted from the treatment.

SYNTHETIC RUBBER PRODUCTION

SYNTHETIC rubber of the Buna S variety, good for tires all the way from jeep to super-bomber sizes, as well as for tank treads and other Army uses, will flow at the rate of 90,000 long tons a year out of a new plant set-up at Charleston, West Va., which has just gone into full-scale production.

Government-owned, the new installation consists of two separate but closely integrated plants, each under the management of a well-experienced industrial organization. The first plant, where the raw materials are produced, is managed by the Carbide and Carbon Chemicals Corporation; the second, where they are converted into the final product, by the United States Rubber Company. The two plants stand side by side, so that a casual observer would think they were one; short pipe lines carry the raw materials from one to the other.

Scarcely over a year ago, there was nothing on the broad, flat plain by the Kanawha River but farm and pasture land adjoining a small airport, near the suburban station called Institute, from the presence there of a state teachers' college. Now the place is an industrial giant, capable eventually of making rubber to rim 16,000,000 civilian car wheels every year.

Buna S is the synthetic rubber made by mixing two organic compounds, butadiene and styrene. Butadiene in turn can be made from either petroleum or alcohol; at this plant alcohol is used. The alcohol is brought up the river by barge or in railroad tank cars; it comes from the great Ohio Valley distilleries that have stopped making liquor to devote their entire capacities to war-alcohol production. A "tank farm" with a total storage capacity of 750,000 gallons insures a constant working supply on hand.

Styrene, the other ingredient, is made here by combining benzene and ethylene. Benzene is produced in abundance near by; it is a coke-oven by-product, and there are many coke-ovens in this valley. Ethylene is one of the lighter petroleum fractions.

Both butadiene and styrene must be brought to a high degree of purity before they can successfully combine to produce Buna S. At this place, the Carbide and Carbon Chemicals plant brings the butadiene to 98.5% purity and the styrene to 99% before putting them into the pipe lines to go over to the United States Rubber plant.

Both chemicals are limpid, water-clear liquids as they flow into the great mixing vessels. As soon as they are well in contact, however, they combine to form a milky fluid—a true latex, filled with billions upon billions of submicroscopic rubber particles.

These are held from combining with each other because all have electrical charges of like sign. The latex is flowed into another great vat, where a salt-water solution containing a little sulfuric acid is mixed in. The salt removes the electrical charges, and the rubber particles stick together in grains or crumbs. These are put through a mechanical shredder and washed thoroughly, to remove all chemicals that may still cling to them. Finally the raw rubber particles are showered down into the oblong mold of a powerful press, that squeezes them into 75-pound blocks. These are packed in cartons for shipment to the tire factories.—FRANK THONE.

ITEMS

EXPORTABLE quinine-bearing bark from the 17,000-acre cinchona plantation at El Porvenir, Guatemala, will be obtained under an agreement announced by the Board of Economic Warfare. A fourth of all Latin-American production is expected to come from El Porvenir. Guatemala is the only source that can supply the anti-malarial drug to this country by land route. A laboratory already has been established at El Porvenir for testing and analyzing bark and studies are being made of the different types of trees found there. It is hoped that a training program may also be undertaken to school people for work in locating and testing other cinchona stands in neighboring republics.

THE potato famine should soon be over. Commercial early potatoes from 363,100 acres of land are ready or soon will be ready for the market. It is an acreage 17 per cent. greater than the early potato acreage for 1942, and 16 per cent. above the ten-year average, 1932–41. Reports just made to the U. S. Department of Agriculture by its crop correspondents and field statisticians indicate the acreage in the states of Georgia, Kentucky, Maryland, Virginia and Kansas is 9 per cent. above the acres harvested in 1942, but is nearly 22 per cent. below the ten-year period. Arkansas, Oklahoma, Tennessee and North Carolina are expected to produce nearly 7,000,000 bushels, an increase of over a million bushels above the amount raised in 1942. The floods of the Arkansas and other rivers in Oklahoma and Arkansas have destroyed many acres of growing potatoes, but the increased acreage in other states will more than balance the losses.

ACCORDING to the Metropolitan Life Insurance Company "in this country as a whole, about six out of every 100 men and women of marriageable ages wed during a typical year." For the South, the figure has been almost nine out of 100, and for the Far West it has been somewhat under five out of 100. The North has been about halfway between. Now the West is having more marriages, especially in the ages under 35, while the South is having fewer. An increase in marriages among the older people and fewer marriages among younger ones is predicted for the future as a result of the war. The company also reports that the current death rate among white children aged 5 to 14 years is under one per 1,000. This is half the rate prevailing only a year ago. There is still considerable room for improvement, the statisticians point out. The five chief causes of death among children of school age are, in order of numerical importance: accidents, appendicitis, influenza and pneumonia, rheumatic fever and tuberculosis. Accidents cause more than a fourth of all deaths of school children in America. These can be prevented and the killing of children by the four diseases can be greatly reduced by further efforts to protect child health.

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Science Service, Washington, D. C.

MULTIPLE STARS

QUADRUPLETS and quintuplets in the sky may not be as rare as they are on the earth, but astronomers get nearly as excited about them. At the Cambridge meeting of the American Astronomical Society several papers dealt with multiple stars, among them a discussion by Mrs. Elizabeth Cornwall Tilley, of the University of Michigan, concerning the plain-seeming star known as 59D Serpentis.

Should 59D Serpentis be called single, as it appears to the naked eye? Or double, as it appears in a four-inch telescope? Or triple, as the spectroscope reveals one of its components to be? Or quadruple, as the sum of its parts would make it? But if quadruple is correct, the quads are not as nearly alike as they usually are among humans.

The star 59D Serpentis is also unusual in that two of its triplet stars are hot, white twins, while one is a cooler yellow star like our sun, only much larger.

One of the standard means for discovering doubleness among stars is to observe their spectra. If two stars are revolving around each other, some of their motion is probably toward and away from us, producing the well-known Doppler shift in their spectra. As one star approaches us along one side of the orbit, its spectrum is shifted toward the violet, while its companion's is shifted toward the red as that star recedes. Thus, two spectra are really being seen, and the lines in the combined spectrum appear double. These double lines gradually blend as the stars proceed along their orbits, then separate again. This is repeated twice for each revolution they make.

Sometimes one star is so much brighter than the other that the second star's spectrum is suppressed and only one set of lines is seen. However, the regular oscillation of these lines around a mean position proves the star to be a spectroscopic double in any case. In only two or three cases, including 59D Serpentis, are three spectra visible, and only for 59D have the details of the system been determined. The white twins revolve around each other once every 1.85 days, at a distance apart of only four million miles. Together, they revolve around the large yellow star, about 180 million miles distant, or the distance across the earth's orbit, in 386 days. These three form the triplet, around which the distant visual companion, also a white star, may require several thousand years to revolve.

The triple spectrum of 59D Serpentis was discovered independently in 1938 by McLaughlin at the University of Michigan and Tremblot in Paris, and in some cases they took spectrum photographs of the star on the same nights.—CHARLES A. FEDERER, JR.

MONAZITE SANDS

THERE are many important uses of the rare-earth metals, and their compounds, obtained from the honey-yellow colored monazite. The principal metals obtained are cerium and thorium. Minor metals obtained include lanthanum, erbium, didymium, beryllium, and others of little or no commercial value.

Lanthanum salts are used in beauty preparations because they give bactericidal action. Erbium salts are astringents. Didymium is used in optical glasses because it protects the eyes from harmful rays. Cerium and thorium are the two elements in monazite which, either in their metallic forms or in compounds, fill essential war needs.

Cerium compounds have many important uses. Cerium acetate protects textiles from mildew and moths, and makes the textiles waterproof. Cerium fluoride mixed with carbon gives arc-lights and searchlights greater luminosity. Cerium oxide is used in ceramics and in the glass industry. The nitrate serves a special function in the gas mantle and also in tanning leather.

Thorium products are equally essential. Metallic thorium or thorium compounds are used in tungsten-lamp filaments, gas mantles, high-temperature refractories, radio-tube filaments, and for other purposes including several in the field of electronics.

Monazite sand is the only commercial source of cerium and thorium, according to the U. S. Bureau of Mines. Our supply, nearly 3,000 tons a year, has come from British India and Brazil. Transportation difficulties have now arisen. The India supply is no longer available.

Monazite sands are found in several places in the United States, but there has been very little domestic production recently because economic operations were not possible when cheaper foreign sands were available. Until 1909 domestic production met American needs. In the war years, 1915–17, the United States relied mainly on home production. From now until the war is over Brazil will be the principal source, unless richer deposits than now known are found in the United States.

NEW DISEASE IN THE ARMY

A MYSTERIOUS disease for which no cause or method of getting it has yet been found turned up in some of the soldiers at Fort Bragg, N. C., late last summer, according to a report published in the *Journal* of the American Medical Association from Lieutenant Colonel Worth B. Daniels and Captain H. Arthur Grennan, two former Washington, D. C., physicians now in the Medical Corps, Army of the United States. They call the disease "Pretibial Fever."

Fortunately the disease was mild. There were no deaths and only forty cases. Because the men all were quartered near one another in a limited area of the reservation and had identical symptoms, it looked as if an epidemic of some sort were brewing.

Chief features of the sickness were fever, lasting about five days, and a rash, which appeared toward the end of the fever and was usually located over the inner, larger bone of the leg below the knee. This bone is the tibia, from which the disease gets its name, pretibial fever. As soon as the fever went down, the men got well rapidly, with no complications, weakness or depression.

Recent Texts in Radio and Related Fields

Radio Engineers' Handbook

By FREDERICK E. TERMAN, Stanford University. 1006 pages, $6.00

One of the most complete works of its kind ever published, this outstanding reference book and handbook presents a wealth of sound, technical information especially selected and organized to meet the needs of the engineer dealing with practical radio and electronic problems. The handbook deals with electronics and vacuum tubes, wave guides, cavity resonators, klystron and other microwave tubes, radio aids to navigation, oscillators, wide-band antennas, and hundreds of other topics of interest to the radio engineer.

Engineering Electronics

By DONALD G. FINK, Massachusetts Institute of Technology. 358 pages. $3.50

A sound, practical treatment of the engineering uses of electronics that the student can easily understand. The book covers the uses of both standard and special tubes in the two important fields of communications and industrial practice, and also deals with such special types as electron multipliers, electron microscopes, electron telescopes, etc.

Microwave Transmission

By J. C. SLATER, Massachusetts Institute of Technology. *International Series in Physics.* 309 pages, $3.50

Steers a middle course between very elementary and very advanced standards; between the highly theoretical and the completely practical. Microwaves are treated both from the standpoint of conventional transmission lines and of Maxwell's equations. Although emphasis is on fundamental theory, enough description of practical methods has been given so that the experimental worker in the field can tie theory and experiment together without great difficulty.

Frequency Modulation

By AUGUST HUND, Member of Navy Radio and Sound Laboratory, San Diego, California. 375 pages, $4.00

Presents a critical engineering treatment of all phases of frequency moduiation, from basic principles to the design of commercial apparatus. Phenomena and features in frequency modulation are described in comparison with customary amplitude modulation and in comparison with phase modulation. A feature of the book is the description of useful receiver tests and the alignment of FM receivers.

Principles of Aeronautical Radio Engineering

By P. C. SANDRETTO, Major, Directorate of Communications of the U. S. Army Air Forces. 414 pages, $3.50

A clear engineering treatment of radio as used in aeronautical navigation and communication, introducing the special factors of the aeronautical problem briefly, then taking up in detail each of the nine radio facilities used in modern air transport practice. Covers the special performance, installation, and servicing factors influencing the design of these facilities and outlines engineering fundamentals and methods that have been developed for handling them.

The Electrical Fundamentals of Communication

By ARTHUR L. ALBERT, Oregon State College. 554 pages, $3.50

Deals with electrical fundamentals from the point of view of communications—telegraphy, telephony, and radio. Designed for beginning students, the treatment is elementary, yet at the same time maintains a high standard of technical accuracy and provides a sound foundation in the subject. Examples illustrating the electrical fundamentals are given throughout the text.

Mathematics for Electricians and Radiomen

By NELSON M. COOKE, Lieut., U. S. Navy; Executive Officer, Radio Materiel School, Naval Research Laboratory, Washington, D. C. 604 pages, $4.00

Provides the electrical and radio student with a sound mathematical foundation, showing him how to apply this knowledge to the solution of practical problems most frequently encountered in actual practice. The mathematical scope of the book includes elementary algebra through quadratic equations, logarithms, trigonometry, elementary plane vectors, and vector algebra as applied to alternating current circuits.

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A commission of experts assigned by the Surgeon General of the Army to investigate the disease was unable to find any germ cause or any method by which the men might have gotten it. Members of the commission were: Dr. John R. Paul, of Yale University Medical School; Dr. Norman H. Topping, U. S. Public Health Service, and Major Cornelius Philip, of the Army.

An outbreak of what may have been the same disease occurred in August, 1940, in Wrens, Ga.

SEPARATING WET FROM DRY GRAIN

AN ingenious method of separating wet from dry grain by use of an electrical condenser has been developed in England. T. A. Oxley, of the Department of Scientific and Industrial Research, and F. Y. Henderson, of the Imperial College of Science and Technology, have presented a method which may prove invaluable in preventing loss of grain through spoiling.

In both England and America large quantities of wheat are lost each year because of the development of fungi in the stored wheat. The fungi start in a moist, warm spot, often buried deep within the grain. It may either spread from there through the rest of the grain, or one such highly developed spot may be sufficient to taint the entire supply and make it unfit for milling. In order to preserve the crop, it is important to eliminate these wet danger spots. To do this by thoroughly drying the entire supply would be very expensive and in many cases impractical.

The more water in the grain, the poorer is electrical conductivity of the mass. As reported in *Nature*, use was made of this fact by passing the grain in a steady stream of uniform thickness between two metal plates acting as a condenser. If the grain is comparatively dry, it is sent down one chute. When the moisture reaches a certain percentage, the decreased electrical current causes a mechanism to divert the stream to another chute. Eventually, when the grain passing through becomes drier, it is automatically switched back to the first chute.

The moist grain is given priority in being dried. Not the entire harvest, but only the damper portions need be heated enough to eliminate the few highly moist spots. With the danger spots removed, all the grain can be safely stored until needed.

A NEW OPTICAL GLASS

BETTER cameras, spectacles and microscopes can be expected from use of a new lens glass developed after ten years' research, is announced by Dr. E. D. Tillyer, research director of the American Optical Company.

Sand, the principal ingredient of ordinary glass, is left out completely. According to Dr. Tillyer, omission of sand is the main reason for the superior optical properties of the new glass. Several common chemicals make up the formula of the new glass: boric acid, zinc oxide and aluminum hydroxide.

Another glass of the same type, but having different properties, is obtained by substituting cadmium oxide for the zinc oxide. This is the first time that the chemical element cadmium has been used as a major ingredient in glass.

In comparison with glass containing sand, the new glasses have higher light-bending power and less tendency to separate light into different colored rays, giving the often-observed rainbow effect. Although glass without sand is not new, these are evidently the first reports of such optical glass which shows commercial possibilities.

The new glass containing zinc oxide was developed by Dr. Tillyer, H. R. Moulton and T. M. Gunn. Mr. Moulton devised the kind containing cadmium. The product is still in a laboratory state of development and will not be available for some time.

ITEMS

A LARGE new double star has been discovered by Dr. J. A. Pearce, director of the Dominion Astrophysical Observatory, at Victoria, B. C. It is the spectroscopic binary, HD 34333, an eighth magnitude star in Auriga. Each part of this new system is a star having 23 times the mass of the sun and revolving around the other in slightly over 4 days, according to a report made by Dr. Pearce to the American Astronomical Society. Its orbital velocity is about 150 miles per second, and as one star passes between us and the other, it may produce a very slight partial eclipse, which Dr. Pearce predicts, but which has yet to be observed. Probably the light changes are small, but it is suggested that accurate observations of the star's light to see if there occur any periodic variations which would be caused by such eclipses. The present distance estimate places the system 3500 light-years from the sun.

PANCAKE diesel engines now powering Navy ships weigh less than a fourth as much as previous marine diesels of comparable power. They put out a horsepower for every four pounds of weight. Details of this new compact engine which occupies only a third the space of more conventional power plants was described at the Cleveland meeting of the Society of Automotive Engineers by J. C. Fetters, of the electro-motive division of General Motors Corporation. The nickname "pancake" stems from the four banks of 4-cylinder radial units stacked one on top the other. This light-weight 16 cylinder engine is upended on its gear box to keep space requirements to a minimum. Other radical departures in design required five years of cooperative research between Navy and General Motors engineers before the engine was ready. Then, just two months after Pearl Harbor, production got under way, and the pancake engines are now being installed in Navy ships.

HIGH-OCTANE gasoline, now available only for the military, will feed small, light peacetime autos, was reported by Dr. C. M. Larson, chief consulting engineer of the Sinclair Refining Company, to the Society of Automotive Engineers meeting in Cleveland. Production of this type of gasoline will probably be detrimental to diesel fuel ignition quality, and will force engineers to design diesel engines which will get the utmost out of low-cetane fuels. Dr. Larson believes that diesel fuels will be on the critical list by next year. He estimated that 1945 production ratio of gasoline to distillate fuel would be seven to one, compared with three to one at the start of the war.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE COOLING PLANET

SNOWSTORMS of silica once showered down on our cooling planet, and primitive life probably originated in the polar regions, according to Dr. Perley G. Nutting, of the U. S. Geological Survey, writing in the *Journal* of the Washington Academy of Sciences. A planet, starting as a mass of vapor torn from the sun and finally evolving into the present condition of the earth, passes through a number of interesting epochs as its temperature falls.

The dense vapors of a planet at 5,000 degrees Centigrade, which is a reasonable temperature for a planet just drawn from the sun by a passing star, would be subject to rapid cooling by radiation from its outer layers, Dr. Nutting suggests. The body would be violently agitated, as slight cooling would permit combinations of the elements. Such compounds would condense to liquids and fall back as rain to where the temperature was sufficient to vaporize and dissociate them.

When the planet had cooled a thousand degrees, the first liquid core would be formed of liquid iron and iron alloys. At this temperature the atmospheric pressure above the liquid surface was estimated by Dr. Nutting to be as much as 32 tons per square inch, as compared with our present atmospheric pressure of 14.7 pounds per square inch.

The first solids, occurring at 3,000 to 2,500 degrees Centigrade, would probably appear as floating on the liquid sphere. Dr. Nutting suggests that the earth's atmosphere at lower levels consisted mainly of heavy metallic vapors and the vapors of a few stable compounds of high density which would condense at higher levels, rain down, and revaporize. At intermediate and higher levels large quantities of water vapor (as much as 1.85 tons per square inch) would condense and rain downwards, but never reach the surface. At the outer limits of the planet would be cool, free gases.

Silica and silicates in various forms would have been created by the time the planet had cooled to 1,500 to 1,200 degrees. Miles deep, they would cover the old core of the earth and suppress all but a few metallic vapors.

THE DECREASED DEATH RATE IN THE ARMY FROM WOUNDS

AMERICAN physicians are saving from five to nine times as many soldiers from dying of battle wounds in this war as was possible in World War I, it appears from casualty figures reported by Brigadier General Norman T. Kirk, the new Surgeon General of the U. S. Army, at the Chicago meeting of the American Medical Association.

The figures he gave covered the period during the phases of the North African campaign before the Army moved up into northern Tunisia. The death rate at that time in the evacuation hospitals was from 2½ per cent to 3½ per cent, compared to a death rate of 15 per cent. to 18 per cent. in evacuation hospitals in the last war. This remarkably low mortality was achieved in spite of great difficulties in evacuation. In some places eight-mile litter carries were necessary to get the wounded from the field to the ambulances. The ambulances had to travel 20 to 30 miles over mountain roads to evacuation hospitals.

For the future, the Army Medical Department hopes to have exclusive airplanes and possibly even helicopters for the evacuation of the wounded. So far in Africa, 13,000 sick and wounded have been evacuated by plane. But these evacuations were in planes used to take supplies forward. Helicopters are being experimented with but so far none is in actual service for evacuation of wounded.

Plasma, surgery and sulfa drugs were credited in that order for the great saving in lives. Sulfa drugs will always come second to surgery and third to plasma in saving the wounded, he said. This is because shock and hemorrhage and bomb or shell fragments are the biggest threats to the life of the wounded.

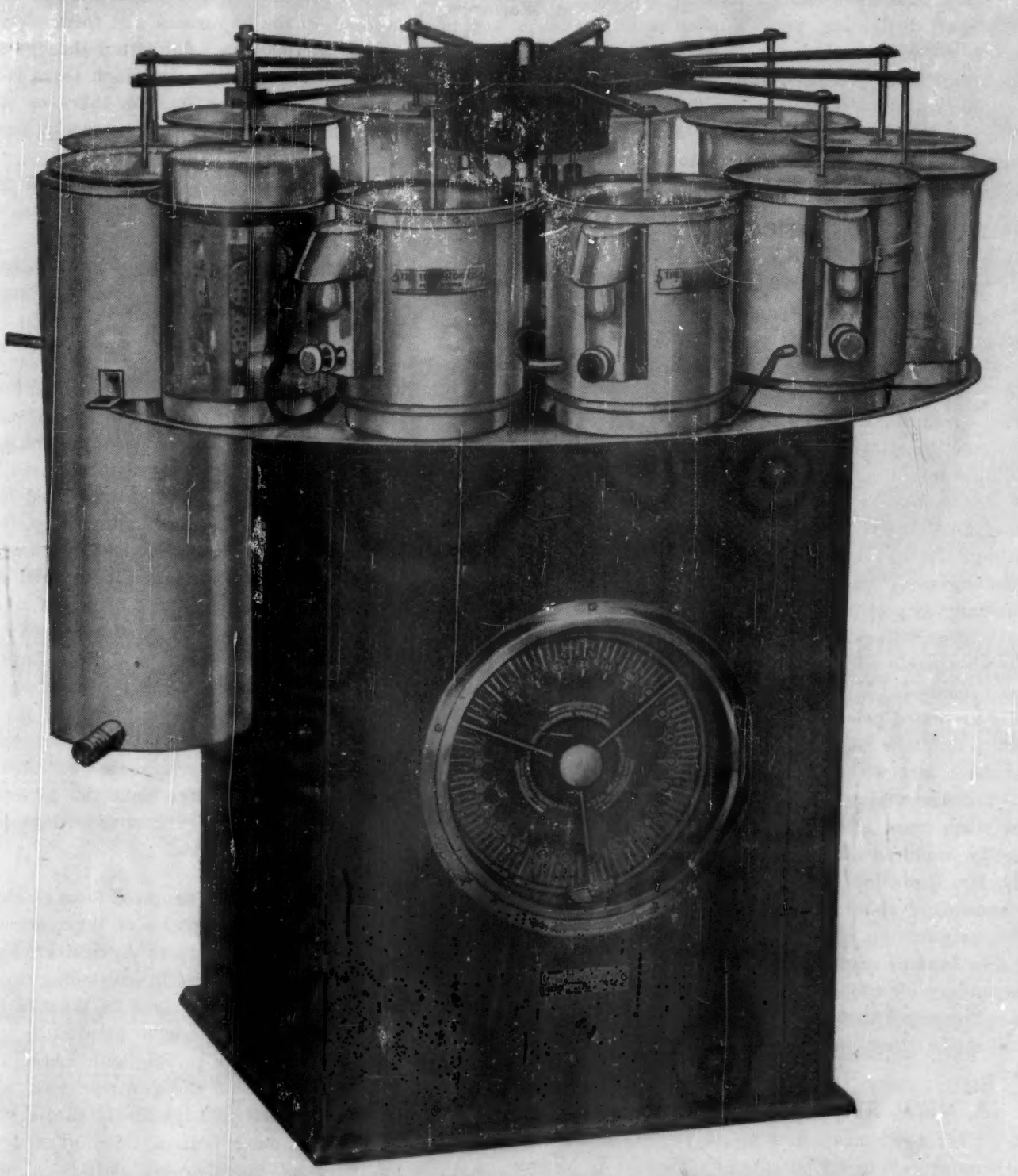
Plasma is given at the clearing stations and sometimes at the collecting stations. At the evacuation hospitals, the surgeons clean the wounds, remove shell or bomb fragments and institute drainage. From 80 per cent. to 85 per cent. of the casualties, he said, are due to shell and bomb fragments, which carry more clothing and infection in the body than rifle bullets. In some places, because of evacuation difficulties, auxiliary groups of surgeons were sent into the forward area to perform operations.

An astoundingly small number of wounded have had the serious bone infection, osteomyelitis, which occurred in 75 per cent. of compound fractures in the last war. In all the base hospitals in Africa, up to April 30, there were only 70 cases of this condition. In one group of 373 compound fractures, there were only five or six cases of osteomyelitis, instead of the 279 which the last war's 75 per cent. rate would have given.

The percentage of survivals in cases of head wounds is much greater than in the last war, as is the survival in cases of abdominal wounds, with even those coming to operation late largely surviving. Of great help for these cases, General Kirk said, is the Levine tube, which goes into the stomach through the nose and by suction keeps the stomach empty and prevents distention. Most fracture cases are transported to the rear in plaster casts, but the casts must be padded. For fractures of long bones, General Kirk is opposed to the method widely used in the Spanish Civil War, of keeping the leg or arm in a plaster cast until the bone sets. Traction is essential in these cases, he said. Only 12 cases of gas gangrene, with one death, occurred, while the Army was still in the South.

The Army has medical installations in every country in the world not held by the Axis, and as soon as it moves into Axis territory, it expects to set up medical units to care for the civilian population. This will be done in order to protect the Army from infectious diseases prevalent among civilians.

The general health of the Army in Africa has been excellent, better than was expected and better even than at home. Venereal diseases are the biggest problem.



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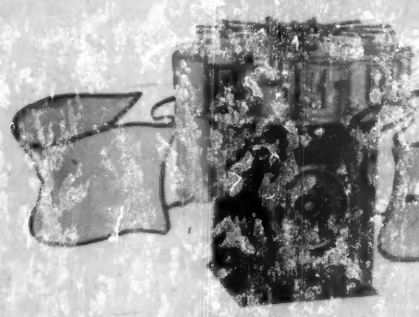

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"We are going to need more doctors," General Kirk declared. "We must have enough to win this war, and we haven't started fighting yet. Tunisia and Guadalcanal were only side plays."

He added that he appreciated fully the need for leaving enough doctors at home to care for the civilian population. He quoted General Eisenhower as saying that the outstanding service of the whole A.E.F. was that rendered by the medical department.—JANE STAFFORD.

METHODS OF RECOVERY OF SECONDARY OIL

NEARLY two thirds of the nation's oil is left underground by ordinary methods of recovery, representing an estimated seventy billion barrel reserve which challenges the ingenuity of petroleum engineers, according to a report by D. R. Knowlton, director of production for the Petroleum Administration for War, to the New York meeting of the American Institute of Mining and Metallurgical Engineers.

"The most economical and consequently the best source of additional oil for our war program, aside from exploratory drilling, lies in secondary recovery," he maintains. "It is the engineers' problem to get as much of that oil as economically as possible."

At least three billion barrels of the residue left after the easily obtainable oil is pumped can be recovered even by present methods, Mr. Knowlton believes, at present or slightly increased price.

Efforts to find new fields at a cost of millions of dollars per year have met with only moderate success. Unless our record of discoveries is substantially better during the next few years than it has been during the last few, our domestically produced oil will be insufficient to meet our demands, Mr. Knowlton warns.

New knowledge about how to keep up pressure in oil reservoirs as pumping continues and how to control the rate of flow enables engineers to recover much of the so-called secondary oil while still producing the primary oil. Mr. Knowlton urges that new research projects be undertaken to study these methods under varying reservoir conditions.

A NEW SMELTING PROCESS

COAL strikes need mean nothing to the steel industry if a smelting process newly patented by Thomas V. Moore, of Houston, Texas, comes into general use, and the supply of natural gas holds out; for the new method substitutes natural gas and hydrogen (which can be made from some types of natural gas) for the coke on which present-day smelting depends.

Instead of charging a blast furnace with alternating layers of coke, iron ore and limestone, as in present practice, Mr. Moore sifts finely-ground iron ore down through a hopper at the top of a tall tower. Part-way down, the ore particles are met by an upsweeping blast of flaming gas, which heats them to the incandescent state at which they are ready for chemical reaction.

Settling slowly through the turbulent blast, the particles next pass into a zone where hydrogen at a high temperature (above 1300 degrees Centigrade) removes the oxygen from the oxide ore, releasing the iron in molten condition. If the ore is sufficiently impure to require a flux, bits of limestone, fed in through the same hopper, here take up the impurities and form a slag.

Next, the iron particles pass downward through a third zone of hot gases, this time one in which there is an excess of uncombined carbon. The iron takes up some of this, to form the iron-carbon alloy commonly known as pig iron.

Molten iron and liquid slag are drained off through separate openings at the bottom of the furnace, so that the process can be made continuous.

U. S. patent 2,321,310, issued on the method, has been assigned to the Standard Oil Development Company.—FRANK THONE.

ITEMS

A DIVERGENT beam has successfully been used in taking x-ray photographs of crystals. This method promises to be extremely useful in studying the arrangement of atoms in the crystal. As a short exposure is required, it will aid particularly in research with short-lived crystals. This new development in x-ray photography, reported by the British Council, was made at the Royal Institution, London, by Dr. Kathleen Lonsdale with a tube designed by Dr. A. Muller. When the planes of atoms in a single crystal reflect a fine x-ray beam, the reflected beams photograph as sharp black spots on a light background. Substituting a divergent beam for the usual cylindrical pencil, the background becomes darker and the former spots open out into curves. Besides the reflection curves, which are black, the photograph shows "deficiency" curves. These lines are lighter than the general background because radiation in certain directions has been removed from the original beam.

BETTER beer and ale can be expected from recent crosses of European and American species of hops, accomplished for the first time at South-Eastern Agriculture College at Wye, Kent. Reports of success in developing five promising new varieties has been received in Washington from the British Council; the hops were planted in this country and Canada, as well as in England. Acceptance for commercial propagation of the new varieties, which are disease resistant as well as superior in flavor, represents the culmination of more than a third of a century of patient improvement breeding initiated by Professor E. S. Salmon, and continued under the leadership of Dr. R. G. Hatton, Jesse Amos and F. H. Beard.

DARK green is not always dark in color to the eye of the camera. A new dark green camouflage paint reflects infra-red rays along with ultraviolet rays, and shows up light in aerial infra-red photographs. The new paint is a development of the du Pont laboratories at Wilmington. Infra-red photography is based on the fact that common objects reflect visible light and infra-red rays in a different manner. Most green vegetation reflects infra-red rays. In the infra-red camera used in aircraft, vegetation appears light. An object surrounded by vegetation and camouflaged with ordinary paint the color of the vegetation stands out black against white in the photograph. With the new dark green paint it is concealed.

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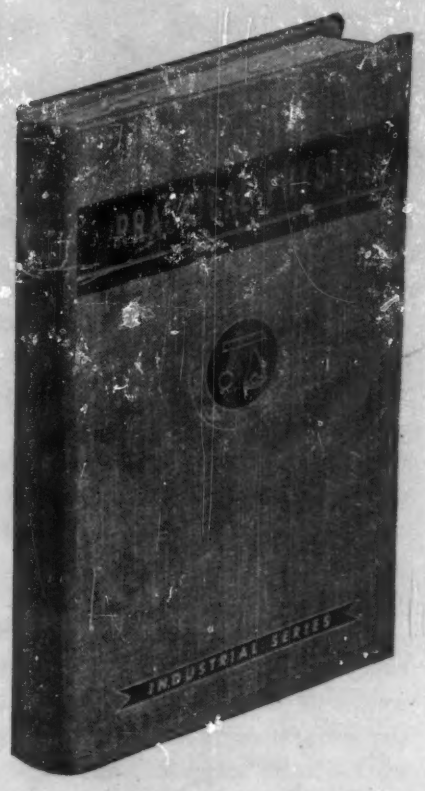

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SCIENCE NEWS

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PROTEIN AS A BY-PRODUCT OF ALCOHOL DISTILLATION

"MEAT" sandwiches without visible meat but rich in body-building proteins may result from a new process developed by chemists of the U. S. Department of Agriculture. A billion pounds of protein could thus be recovered annually by alcohol distillation from wheat. Equipment has already been designed for commercial production based on the process developed by Irwin W. Tucker, working under Dr. A. K. Balls, chief of the enzyme research laboratory of the department. Wheat is treated with sodium sulphite solution, a plentiful waste product of paper mills and other industries. The extracted protein clots and rises to the surface as a thick, yellow froth. When dried it looks much like dried egg white.

The protein is suitable for human consumption, especially when granular flour is used in the process. Its cost would be only about five cents a pound. Some look for the protein enrichment of bread, which would help make up for meat supplies that have been nearly cut in half. Cereal products could be similarly treated. Essential chemical products, such as casein, are also possibilities.

Meanwhile, distillers expect to use the solution that is left after the protein separation to replace barley malt, now the most expensive single ingredient of the alcohol distillation process. This, together with the protein by-product, will save the government $50,000,000 on the 500,000,000 gallons of war alcohol being bought from distillers annually.

After the war we may look forward to large-scale production of grain alcohol for synthetic rubber and other industrial products. Fully developed, the new process will cut former prohibitive costs of peacetime grain alcohol production by at least half. Some say it will pay for the production of the alcohol and then debate as to whether the protein or the alcohol is the by-product.

Production problems will also be solved by the Balls-Tucker discovery. Sticky gluten, extracted by the new process, has been gumming up distillation equipment, thereby forcing frequent shutdowns. In addition, the process reduces the distillation residue to a thin liquid which is much easier to dispose of than former wastes. Protein has heretofore been recovered at the end rather than at the beginning of distillation, and the product was good for little but livestock feed. The new, simpler process gives higher yields and the product is pure enough to be used in human food.

VOCATIONAL COURSES IN ENGINEERING

MORE than a million young men and women have received special training in engineering, scientific and technical subjects, to fit them for specific tasks in the armed services and in the nation's industrial war effort, according to the report of Dean A. A. Potter, of the Purdue University engineering department, speaking before the Lafayette, Ind., meeting of the American Society of Agricultural Engineers. This does not mean, however, that we have added a million engineers to our professional ranks. The courses given are to a large extent below college level, are designed specifically for particular ends, and do not lead to degrees.

"It is to be hoped," Dean Potter said, "that the experience which our engineering colleges have gained through the war training programs will be capitalized by them during the post-war period, not only in improving their regular programs of study leading to degrees, but also in establishing a large number of technical institutes all over the country with intensive practical programs closely linked to the needs of the industries in the communities."

There is an extreme need, he continued, for fully trained engineers, which is not being met by the present regular programs of the engineering schools. The National Roster of Scientific and Specialized Personnel estimates that 40,000 to 50,000 additional engineers will be needed during 1943 and that the potential college production during the current academic year is only 17,000.

Intensive efforts are being made to close the gap, which the speaker described. Thousands of young men in V-1 and V-7 classifications are being given special courses in a number of colleges, under Army and Navy auspices, and they will be given V-12 classification and assigned to continue their studies on completion of the preliminary courses. By streamlining the professional curricula, and by cutting vacations to a minimum, it is expected that a new supply of well-trained engineers can be brought out in much less than the conventionally required time.

One hitch looms: unless the present Selective Service regulation on deferment is changed to extend the period beyond July 1, 1945, "a serious gap in the continuity of supply of engineers will develop very shortly. In general, the needs of our war industries will not be fully satisfied unless an 'industry reserve' or some other scheme is set up . . . for the purpose of insuring an adequate supply of engineers."

BISMUTH AND RECOVERY FROM MALARIA

GIVING a bismuth compound with quinine may speed recovery in some cases of malaria, is suggested by Dr. Martin D. Young, Dr. Sol B. McLendon and Dr. Roy G. Smarr, of Columbia, S. C., in a report to the *Journal* of the American Medical Association. This report is based on paresis patients who were given malaria to cure their syphilitic condition, but it is stated that the combination of thiobismol and quinine "might be useful in malaria infections generally."

The bismuth compound seems to injure the half-grown vivax malaria parasites and reduce their numbers in the blood. As a result the drug eliminates the fever paroxysms which that brood of parasites would have produced. For patients of syphilis of the brain and nervous system, this means that the malaria given to cure their

syphilitic condition can be controlled to produce fever paroxysms every other day instead of every day. The daily paroxysms often tax the patient so severely that he can not continue the full course of treatment.

For curing the malaria, once its effect on the syphilis has been achieved, quinine is usually given. Quinine, however, frequently does not prevent the occurrence of the fever paroxysms for several days after it has been started. When the bismuth compound is given at the same time as the quinine, it prevents the paroxysm of the next day and after that the quinine controls the infection.

The bismuth compound used was sodium bismuth thioglycollate, known also as thiobismol. The studies were made at the South Carolina State Hospital, to which Dr. McLendon and Dr. Smarr are attached. Dr. Young is stationed at the malaria research laboratory at Columbia of the U. S. Public Health Service, National Institute of Health.

THE JAPANESE EARTHQUAKE

SEISMOLOGISTS of the U. S. Coast and Geodetic Survey reported after study of telegraphic and radio data transmitted through Science Service from a number of American and overseas observatories that the earthquake on Sunday, June 13, off the coast of Japan, was twins, with one shock at 1: 11.7 A.M. and the other at 4: 36.5 A.M., EWT. Both quakes started from beneath the same epicenter, which was in latitude 37.5 degrees north, longitude 142.5 degrees east.

This spot is in the Japan Deep, a "hole in the bottom of the sea" off the northeast coast of Honshu, the main Japanese island. It is possible that a tidal wave was caused. Such a wave was started by an earthquake under the same deep, but a few score miles northward of Sunday's epicenter, on March 2, 1933; it sent a 96-foot wave charging up narrow Ryori bay, and drowned out a number of fishing villages all along that coast. However, even if a big wave was started by the present double earthquake, it is not likely that material damage would be caused in the Tokyo-Yokohama industrial area, which is well to the south.

Another pair of earthquakes was reported from the China sea a few days before. Both occurred on Tuesday, June 8, but data from the remoter observatories were delayed in transmission. The first shock which started at 4: 42.2 P.M., EWT, centered in latitude 19 degrees north, longitude 116 degrees east. This is in the north central China sea, about midway between Luzon and the Chinese island of Hainan. The second occurred at 11: 06.7 P.M., EWT, and had its epicenter in latitude 9 degrees north, longitude 120 degrees east, in the northern part of the Sulu sea, in the southern Philippines. Both were strong shocks.

Stations reporting were the government observatories of Sydney, Australia, and Wellington, New Zealand; the Franklin Institute, Philadelphia; the Des Moines, Iowa, Observatory; the observatories of the Jesuit Seismological Association at St. Louis University and Weston College, Mass., and the stations of the U. S. Coast and Geodetic Survey at Sitka and College, Alaska; Tucson, Ariz.; Chicago, Ill., and Honolulu, H. T.

ITEMS

A NEW research laboratory, built at Akron, Ohio, at a cost of $1,325,000 by the Goodyear Tire and Rubber Company, is now ready for operation. It was dedicated at a two-day symposium on June 22 and 23, in which outstanding research workers representing many leading industrial and scientific laboratories participated. The laboratory building contains 74,000 square feet of floor space, and will house the activities of a large part of the Goodyear research staff, which at present comprises 125 chemists, physicists, engineers and metallurgists, along with some 400 others who spend full time on field work. Included in the equipment are such powerful research tools as an electron microscope, an analytical spectrograph and an infra-red spectrometer. All research work at present is of course devoted to winning the war. When victory comes, it will return to normal peacetime pursuits.

POTATO growers in parts of the country where length of season permits two crops a year to be produced are having difficulty in obtaining enough seed potatoes to put in the second crop. For their benefit, Dr. R. A. Jehle, state plant pathologist at the University of Maryland, suggests possible use of seed pieces from this year's early crop, chemically treated to induce them to sprout without waiting through the rest period usually required by seed potatoes. The treatment, first developed at the Boyce Thompson Institute for Plant Research in Yonkers, N. Y., consists in soaking the cut seed pieces for an hour in a solution of sodium thiocyanate, one pound of the chemical to 12 gallons of water. It is essential that the seed potatoes have a cut surface; whole ones will not respond.

CORN yields in bad years, when the weather is either too wet or too dry, can be materially increased by putting commercial fertilizer in the bottom of the furrow as the field is plowed, instead of spreading it broadcast as is now the practice. This discovery was made by agricultural engineers at the Indiana State College of Agriculture at Lafayette; it is reported in detail in the new issue of *Agricultural Engineering*. The problem, it is explained, was to get into place for most efficient use the second, or "sustaining" application of fertilizer. The "starting" fertilizer is already placed in strips at the right distance from the seed as planted. A mechanical attachment for use with plows has been developed, which drops the fertilizer at properly spaced intervals in every second furrow.

TEST periods for heavy-duty diesel lubricants have been cut from nearly three weeks to only a day by development of a new test engine. Success of a single-cylinder Fairbanks-Morse engine as a research tool was reported to the meeting of the Society of Automotive Engineers by H. L. Moir, W. J. Backoff and N. D. Williams, of the Pure Oil Company. Their tests revealed that ring-sticking or sluggish ring action caused more power loss than increased piston temperatures. Variations in ring-sticking time for each type of lubricant are reported due to differences in refining and sources of crude. Although some oils cause less ring-sticking, they may produce dirty pistons, so cleanliness also had to be considered in evaluating and producing heavy-duty type lubricants.

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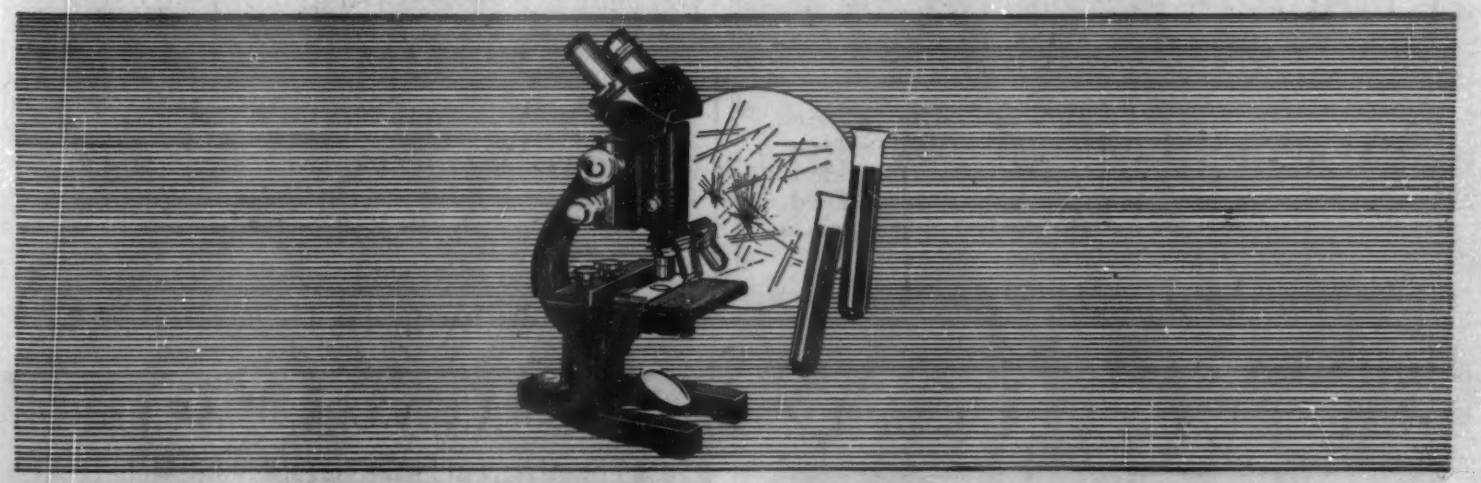

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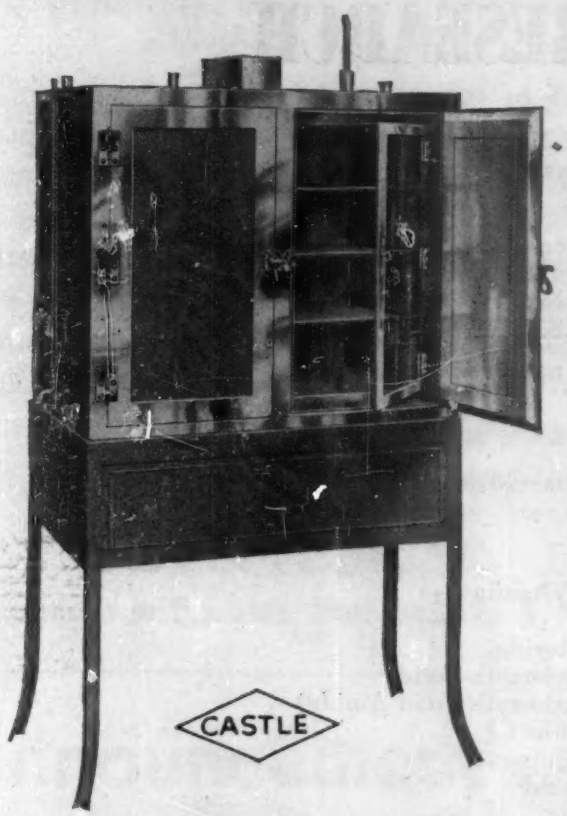

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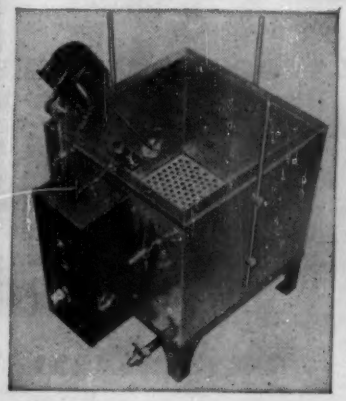

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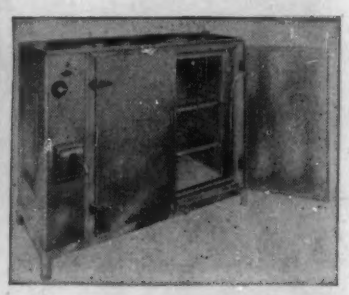

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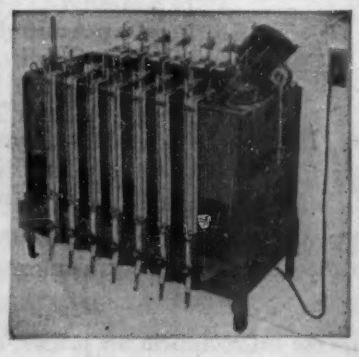

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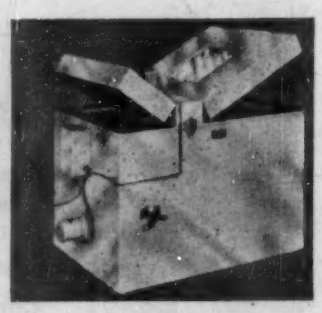

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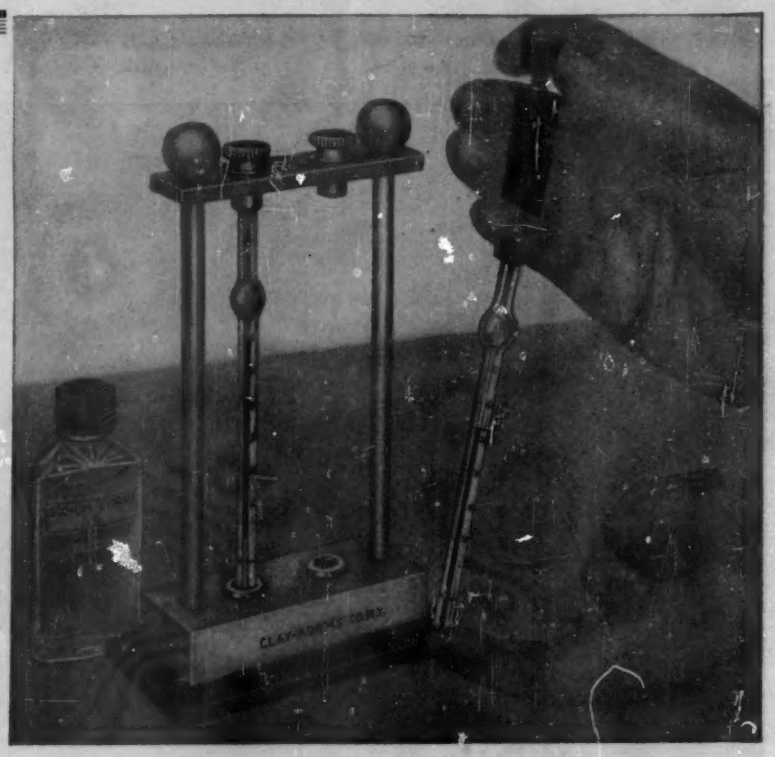

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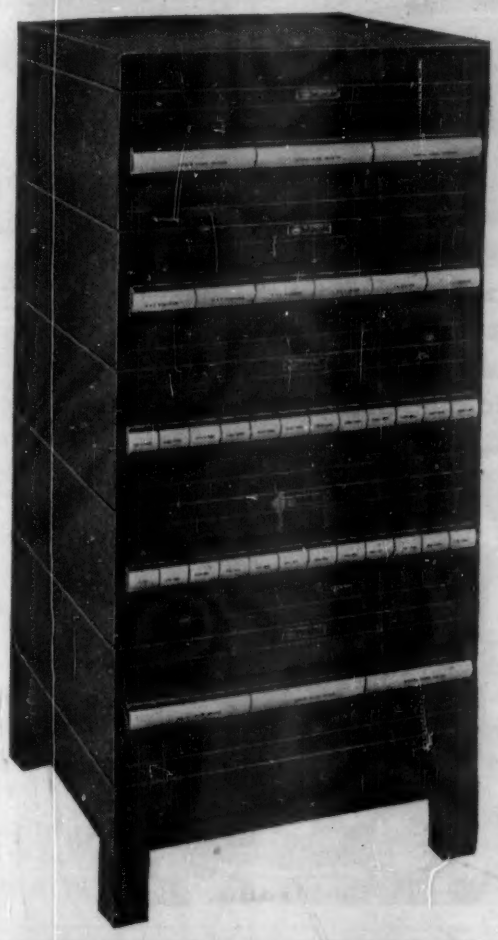

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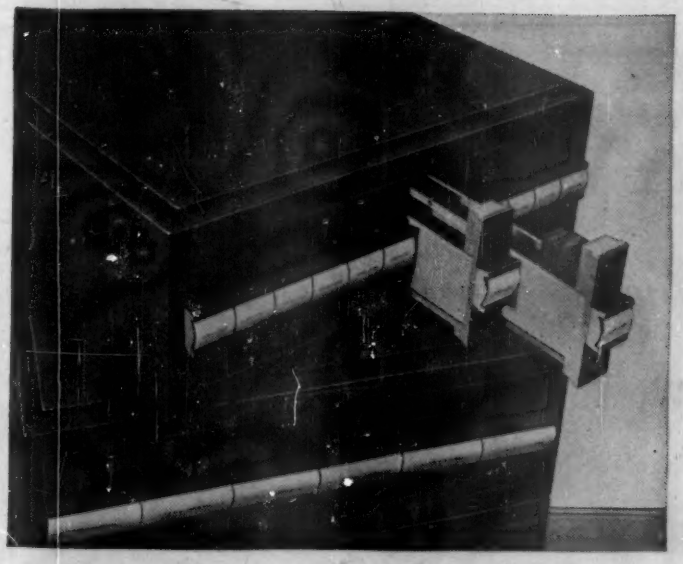

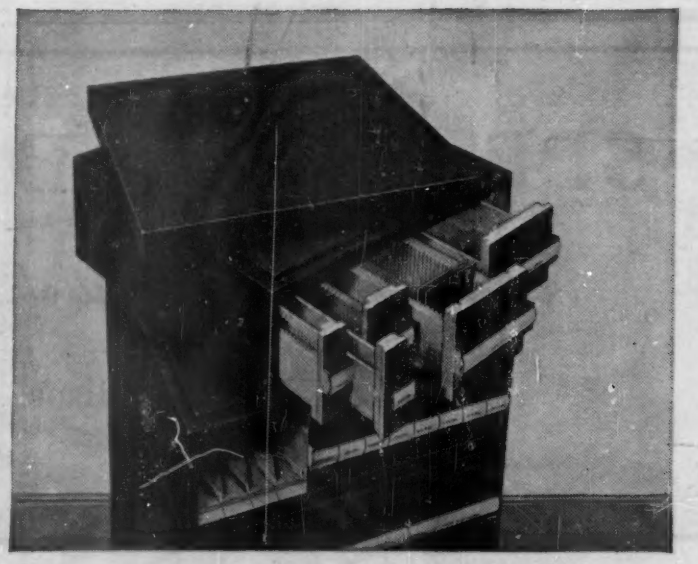

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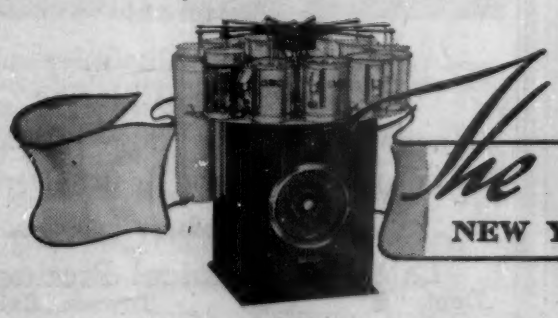

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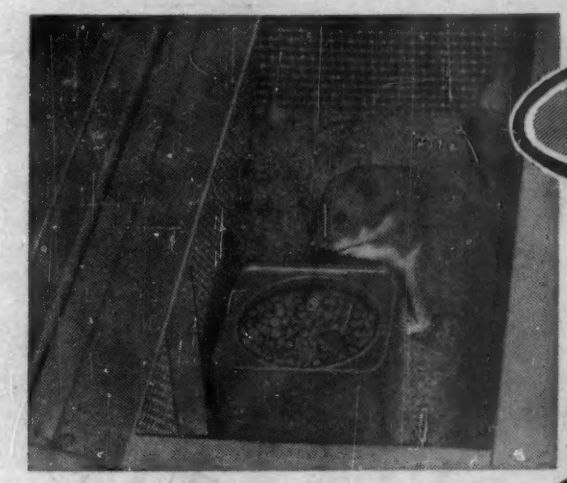

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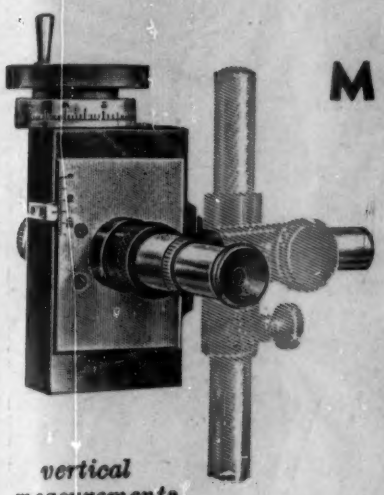
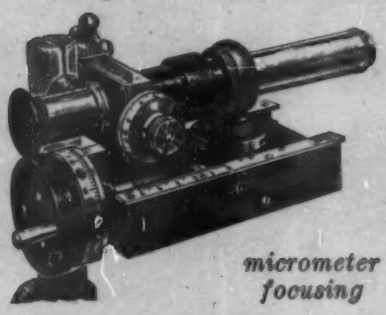


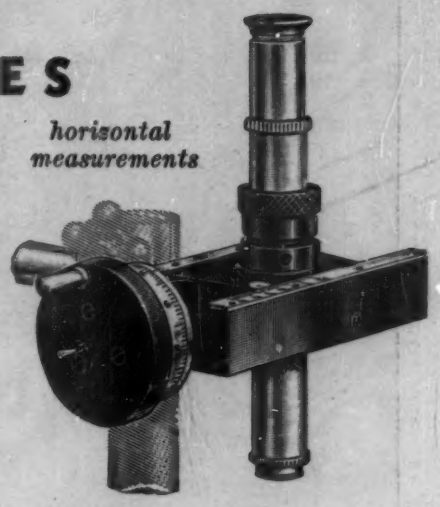
vertical measurements

depth measurements



micrometer focusing

horizontal measurements



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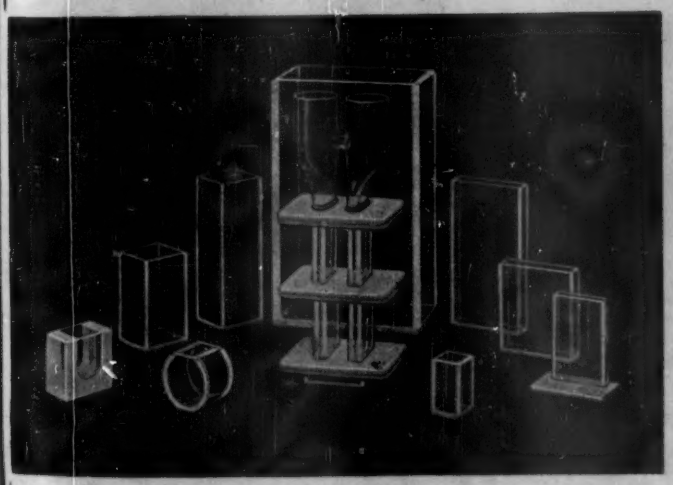

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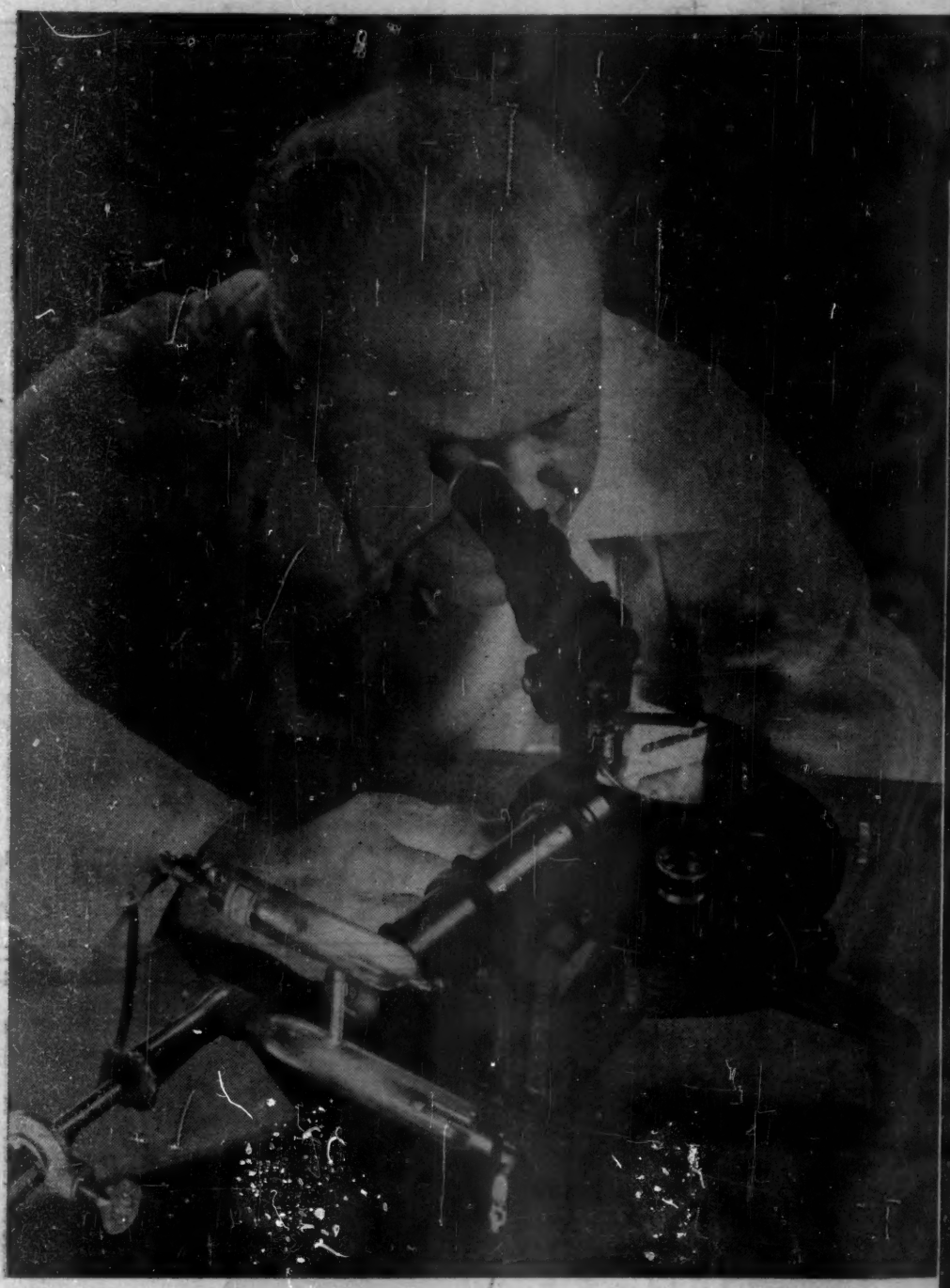

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